The FOUNDRY

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Coal Mining Machinery Uses Variety of Castings

ALTHOUGH numerous fuels are employed as heat producing mediums for the home, coal still retains its leadership in that field. It also supplies a large amount of the heat for industrial purposes. Coal is the basis of the generation of electrical energy through its use in steam

A Large Percentage of the Coal Produced Is Mined by the Undercutting Method

boilers, and the railroads, the backbone of the national transportation system, use many thousands of tons annually. When coal first was discovered, people did not know what it was or how to use it. One story is told of how streets were paved with coal. From that meager beginning, the coal mining industry has grown to be one of the large industries of the United States. According to the *Commerce Yearbook*, published by the U. S. department of commerce, 609 million short tons were mined in the United States in 1929. Of that total, a large portion was mined by machine. Of course, castings play an important part in the mining industry. Many machines such as those used for undercutting, drilling, transportation, handling, cleaning, ventilating and crushing contain a large number of castings.

Find Where Castings Can Be Sold

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John Howe Hall

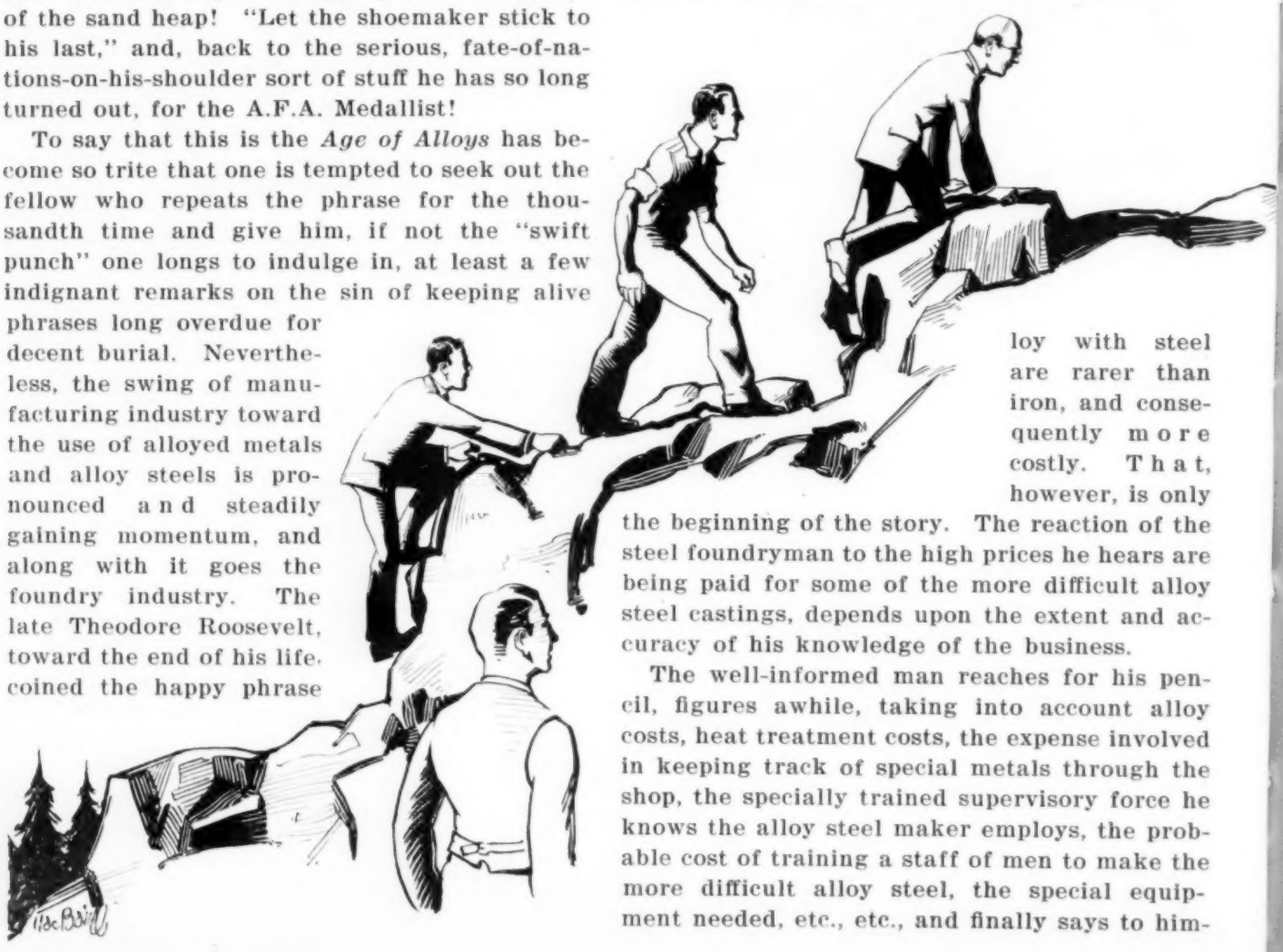
Exposes the

LURE OF ALLOYS

THE editors of THE FOUNDRY having suggested that an article along the general lines indicated by the title might be timely, one is tempted to indulge in the well-known wisecrack and show off one's cleverness, if any, with a few snappy phrases such as "He didn't know it was loaded," or "Who put the 'Oy' in alloy?", or something like that. But with the inimitable Pat Dwyer holding unchallenged sway over the field of imparting foundry information nicely compounded with hilarity, what chance has a solemn-looking guy like the author, whose sense of humor was "born to blush unseen"—at least by the majority of the brethren of the sand heap! "Let the shoemaker stick to his last," and, back to the serious, fate-of-nations-on-his-shoulder sort of stuff he has so long turned out, for the A.F.A. Medallist!

To say that this is the *Age of Alloys* has become so trite that one is tempted to seek out the fellow who repeats the phrase for the thousandth time and give him, if not the "swift punch" one longs to indulge in, at least a few indignant remarks on the sin of keeping alive phrases long overdue for decent burial. Nevertheless, the swing of manufacturing industry toward the use of alloyed metals and alloy steels is pronounced and steadily gaining momentum, and along with it goes the foundry industry. The late Theodore Roosevelt, toward the end of his life, coined the happy phrase —"The lunatic fringe on the skirts of every new movement." With due apology to the readers for the implied reflection on the intelligence of some of the brotherhood, let us understand at the outset that the idea back of these articles is to point out to the unwary foundryman, and to the unwary buyer as well, the chances of loss involved in becoming a part of the "lunatic fringe on the skirts" of the alloy steel movement.

In general, alloy steels command a better price than ordinary steel castings, as naturally one can not add expensive metals to steel without paying for them. All the metals used to alloy with steel are rarer than iron, and consequently more costly. That, however, is only the beginning of the story. The reaction of the steel foundryman to the high prices he hears are being paid for some of the more difficult alloy steel castings, depends upon the extent and accuracy of his knowledge of the business.

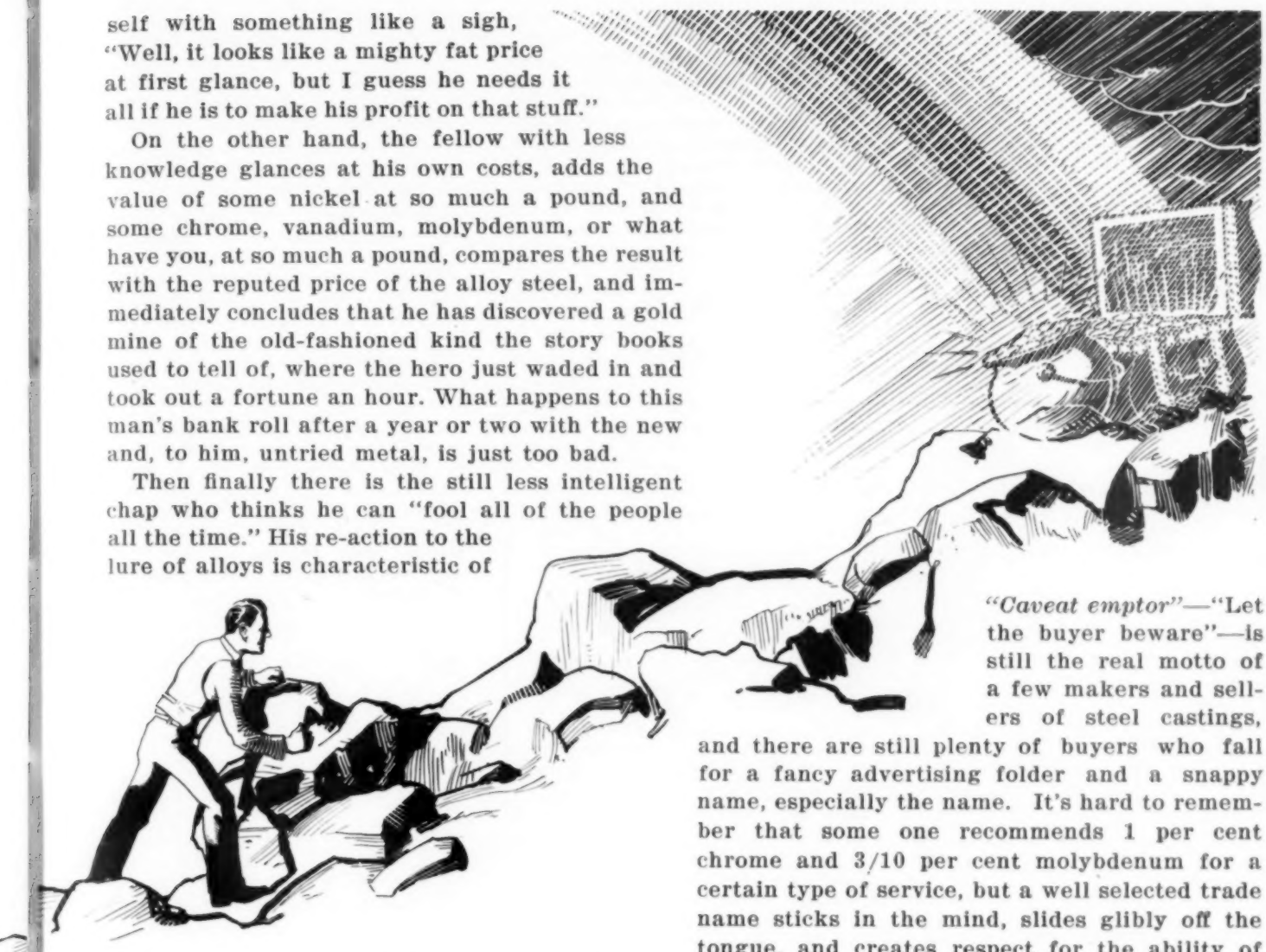


The well-informed man reaches for his pencil, figures awhile, taking into account alloy costs, heat treatment costs, the expense involved in keeping track of special metals through the shop, the specially trained supervisory force he knows the alloy steel maker employs, the probable cost of training a staff of men to make the more difficult alloy steel, the special equipment needed, etc., etc., and finally says to him-

self with something like a sigh, "Well, it looks like a mighty fat price at first glance, but I guess he needs it all if he is to make his profit on that stuff."

On the other hand, the fellow with less knowledge glances at his own costs, adds the value of some nickel at so much a pound, and some chrome, vanadium, molybdenum, or what have you, at so much a pound, compares the result with the reputed price of the alloy steel, and immediately concludes that he has discovered a gold mine of the old-fashioned kind the story books used to tell of, where the hero just waded in and took out a fortune an hour. What happens to this man's bank roll after a year or two with the new and, to him, untried metal, is just too bad.

Then finally there is the still less intelligent chap who thinks he can "fool all of the people all the time." His re-action to the lure of alloys is characteristic of



a class of men, once common in all lines of industry, but now happily passing off the scene. Reaching for a glossary of metallurgical terms, he figures out just how little of how few metals he can add to his steel and still not be legally liable to suit if he sells it as an alloy steel, rings up the man who writes his advertising copy, and launches a sales campaign deliberately intended to steal a share of the profits of the legitimate maker of improved metals, without really delivering the goods. That man is actually the stupidest of the three because he tries to depend upon the ancient wheeze about a sucker being born every minute, and does not realize how much harder one has to work now-a-days to sell a lie, and to find alibis and excuses for the failure of one's fancy-named metal to meet the (generally implied) guarantees under which it is sold, than to make a really good product and sell it only where it is needed.

The latter type probably is a vanishing one, but let it be distinctly understood right here and now that the shyster has not yet gone the way of the dodo and the New England tin peddler.

"Caveat emptor"—"Let the buyer beware"—is still the real motto of a few makers and sellers of steel castings, and there are still plenty of buyers who fall for a fancy advertising folder and a snappy name, especially the name. It's hard to remember that some one recommends 1 per cent chrome and 3/10 per cent molybdenum for a certain type of service, but a well selected trade name sticks in the mind, slides glibly off the tongue, and creates respect for the ability of the concern that has coined a term with so much punch to it. Far too many of these snappily christened materials are found on closer acquaintance to contain a minimum of alloying elements, often ill-selected for the service for which the metal is sold; to be only annealed or, worse still, sold in the cast condition, when double heat treatment is essential if the benefit of the alloys is to be obtained; to be recklessly recommended for almost any type of hard service from sandblast nozzles to gas engine crank shafts, and so on ad nauseam.

It is not the author's intention to dwell longer on that sort of thing, except to point out to the buyer that in the alloy steel business the fellow who knows the exact answer to every question, and is able to recommend right off the bat just the proper metal for any class of service you can mention, is probably a liar, and one of the class we have been describing. The use of alloy steels is so new that there is still a lot to learn about them, and the man with real knowledge of the subject seldom says—"Oh, yes, our 'Hitchy—Kitchy Ninety-two'—is exactly the metal to fill

your needs, and cure your troubles."

Far more likely his statement is "Well, Mr. Buyer, the sort of service you describe is pretty tough on steel, and we have never furnished castings for exactly the conditions you are up against, but I believe the thing to try is such-and-such, and we shall be glad to furnish you enough castings to make a service test." Sometimes, wonderful to relate, he even says "Why, chilled iron castings are what you need, and the So-and-so outfit can give you good ones that ought to fix you up all right."

What, then, are alloy steel castings, what are they used for, and why do they cost so much more than ordinary carbon steel? When a steel casting is to be used for some class of service in which it has been found that ordinary carbon steel will wear out, rust out, corrode out, or break so rapidly that its use is uneconomical, plainly a better material must be found if the machine or installation, of which the casting forms a part, is to pay for itself. The casting must be stronger without being too heavy, more resistant to rusting or corrosion, or better able to resist some sort of wear, than ordinary steel. By the judicious use of alloys and of properly chosen and controlled heat treatment, these desirable properties can be secured to a greater or less degree, but "At a price, Steiner, at a price, remember," to quote the old Scot who had salvaged Steiner's abandoned tramp freighter on the high seas and was preparing to get his pay out of Steiner for the job.

The layman's idea of alloy steel castings is curiously warped by the fact that for many years there was but one such material made in any quantity, Hadfield's manganese steel, and by the further fact that there was only one grade of manganese steel. That remarkable metal differed so markedly from ordinary cast steel in all its properties that people came to think of it as *the* manganese steel, and formed the mental conception that manganese steel necessarily meant a metal of the peculiar charactertistics of the Hadfield product. Thus they thought in terms of A—ordinary carbon steel, and B—Manganese steel, the latter signifying to them only a single metal. The broad term Manganese Steel had lost its general meaning, and had come to mean to them a single variety, so to speak, of a broad class of metals containing varying amounts of manganese. Probably another generation will pass before manganese steel becomes generally accepted as a broadly descriptive term for a number of metals, all containing a considerable amount of manganese, but differing from each other as markedly as the 12 per cent (Hadfield's) manganese steel differs from plain carbon steel.

That mental attitude was the more easily adopted because the properties of Hadfield's manganese steel are determined chiefly by the 12 to 14 per cent of manganese it contains, and are but little affected by quite wide variations in the proportion of the other important elements, carbon and silicon, ordinarily present in steel. So long as the manganese is kept within the proper limits, the carbon may vary over a 40 point range, and the silicon even more widely, with but little effect upon the physical properties of this steel.

In that way it came to be taken almost for granted that with each metal added to steel, a definite product, with definite, unique physical characteristics, is produced. The layman thinks of chrome steel, vanadium steel, nickel steel, molybdenum steel, etc., as definite materials, with characteristic properties determined by the alloying element present, as those of 12 per cent manganese steel are fixed by that amount of manganese. That in the great majority of the alloy steels now manufactured the alloy acts chiefly as an intensifier of the effect of the carbon, and that the properties of a nickel or a chrome or a molybdenum steel vary from those of the softest and toughest structural grades to those of glass hard and glass brittle metals like chilled iron, is entirely unknown, not only to buyers but to many actually selling alloy steel castings.

Table 1

Classes of Alloy Steels

A. Primarily for extra strength and toughness.	1.	Low alloy content. Properties determined largely by carbon per cent, and by heat treatment. Alloys used: Nickel, chromium, molybdenum, vanadium, manganese, tungsten, cobalt, zirconium, and others.
	2.	High alloy content. Not made for strength and toughness only.
B. Primarily for resisting wear.	1.	Low alloy content. By use of high carbon per cent, or by medium carbon per cent plus heat treatment, hard metals are produced. Same alloys as Class A.
	2.	High alloy content. Properties governed chiefly by the alloy per cent. Variations in carbon per cent not very important. Heat treatment generally required. Some of these metals also fill the requirements of Class A 2. Alloys used, manganese, chromium, nickel, and sometimes others.
C. Primarily for resisting rust and corrosion from heat or from chemical attack.	1.	Low alloy content. Includes metals with small amount of copper, molybdenum, etc., to reduce rusting. Seldom made as castings.
	2.	High alloy content. Includes the stainless and rustless steels, containing large percentages of chromium and nickel, with or without smaller amounts of tungsten, molybdenum, zirconium, copper, sulphur, phosphorus, titanium, vanadium, etc. Machining properties and corrosion resistance greatly affected by carbon per cent, which often must not exceed certain definite amounts. Heat treatment generally required.

When Pigs Are Not Pigs

Frequently a salesman will phone in and say he has an inquiry for chrome steel or for nickel-chrome steel, and be greatly surprised when he is compelled to go back and find out what kind of chrome steel is required. "Why, my customer wants *chrome* steel; don't you make chrome steel right along?" Probably we do, but it may be a chrome steel as different from what the customer's conditions call for as chilled iron is different from structural steel.

As this is not a treatise on alloy steels, but only a general article setting forth the difficulties and extra costs involved in alloy steel manufacture no attempt will be made to catalog even the commonest grades, but we shall only mention the classes into which alloy steels may be divided, and the characteristics of each type. Perhaps the subject will be made clearer by a tabular summary as shown in Table I.

Of course the data does not constitute a hard and fast classification, especially as some of the alloy steels made could be cataloged in two or perhaps three of the classes. Thus, for instance, while 12 to 14 per cent manganese steel is intended primarily for resisting wear and so is placed in Class B 2, yet its tremendous toughness and high strength permit one to consider it also as belonging in Class A 2. Similarly some steels belonging in Class A 1 because they possess great strength and toughness, may be classified also in Class B 1 because they will resist

certain sorts of wear better than simple carbon steel.

Castings in which great strength and toughness are desired usually are wanted for parts of machines in which they are subjected to heavy stresses and shocks, frequently associated with more or less severe wear. The number of different combinations of alloys and carbon percentages that are made for service of that sort run into the scores, if not the hundreds, and the physical properties of the steels produced vary over a wide range, from the soft and extremely tough, to the hard or moderately hard grades with high strength and comparatively low ductility.

Long Experience Necessary

For any given type of service, to furnish a metal with just the right combination of strength and toughness calls for proportioning the alloys and the carbon content of the steel, and varying the heat treatment, in such a way as to secure the desired results. The maker of the castings must know, first the physical properties required, and second, how to secure them at the minimum expense, and this knowledge is not acquired overnight, but is gained only after a long and varied experience in furnishing special grades of steel.

These remarks apply with even greater force to the manufacture of steels of Class B, intended primarily for resisting wear. There the problem of furnishing the proper metal is tremendously complicated since there are hundreds of different kinds of wear, and a metal that resists one kind of wear very well may be ill suited to wear of another type. Unfortunately, too, no wear testing machine is available which will classify the wear resistance of steels and irons, except for service in which the type of wear closely approaches that to which the specimens are subjected in the test.

Thus the various wear tests using a grinding wheel, or a wheel applied to the specimen under a stream of fine sand, serve fairly well to determine the resistance of a steel to crushing fine ore or rock between two rollers revolving at different rates, but give almost no idea of the relative abilities of two metals to stand up under the rolling friction of a car wheel on a rail, or the wear and pressure to which a crusher jaw is subjected. Again, resistance to wear of certain types may vary directly with the hardness of the steel, but in many cases the harder steels resist less effectively than some of the softer metals.

For many years the field of wear resistance was left to 12 per cent manganese steel, which was used in hundreds of applications where it paid for itself handsomely, and in a smaller number of cases it was supplied where other metals, if available, would have served better. Formerly the choice being between 12 per cent manganese steel and plain carbon steel. the former was selected because it was the best available, though not always the best possible, material. Today it is recognized that there are some applications where other alloy steels will pay better than manganese steel, and an increasing tonnage of these other metals is being produced.

However it should be pointed out that many casting producers, either through ignorance or through the belief that the public soon forgets a stinging, are taking an unfair advantage of the frankness of the manganese steel makers in pointing out the deficiencies of their material. These rash ones are recommending steels, usually trade named, in scores of cases where, they say, manganese steel is not successful, and are making broad claims for the ability of their product to stand up in such service. The buyer should take note that these steels seldom actually are guaranteed to stand up, with a genuine offer to allow settlement on the basis of service received, as is always done by the maker of manganese steel castings, or by any foundryman who really knows his wear and the steels suited to resist it.

The whole subject of wear resistance and wear resisting steels is so new that really astonishingly little is known about it, and the chances of loss through supplying castings that do not give satisfactory life is very great. To be sure, exactly the same thing is true of the steels intended to resist severe stresses and shocks. Over-enthusiasm, in pushing the strength too high at the expense of the requisite toughness, has cost many a firm a pretty penny in broken castings. But in the matter of wear the danger of going wrong is far greater; "Wide is the gate and broad is the way that leadeth to destruction, and many there be which go in thereat."

Number of Alloys Are Legion

Finally, we turn to the even newer field of metals intended to resist rusting, the attack of chemicals, and high temperature corrosion, with or without accompanying high pressures, as in steam lines and oil cracking stills. Here the number of *rust proof, stainless,* etc., steels and irons is legion, the patent situation is most involved, and the claims made for different classes of steel are often exaggerated almost beyond belief. The casting of these alloys is difficult, their properties in the cast state are generally quite different from those of the same metal when forged or rolled, and a great deal of the information given out is based on tests of the rolled product, under the impression that the cast steel and the rolled steel will behave exactly alike, a rash and frequently false assumption.

New compositions are being developed almost daily, some with a view to making the metal more easily machinable, some to improve its strength and toughness in certain ranges of temperature, or its resistance to corrosion by certain chemicals that attack all alloys so far known. Some of these alloys are suited only for certain temperature ranges, becoming weak or brittle under other temperature conditions; some resist certain chemicals perfectly, and corrode badly when exposed to others; some are rust proof only when heat treated and given a highly polished surface; some require only polishing or only heat treatment, etc., etc. To keep even reasonably close track of the developments in composition and heat treatment of these steels takes a large part of the time of men already familiar with the subject, and with sufficient technical knowledge to digest and assimilate the vast amount of data being published every day. Some of it is correct, some is mere guess-work, and some perhaps is pure bunk. To winnow the wheat from the chaff is a task for a man who knows his stuff and is used to weighing technical evidence.

This is the first of two articles by Mr. Hall on "The Lure of Alloys." The second and concluding installment will appear in the Aug. 1 issue.

THE EDITORS.

Electrochemists Award Acheson Medal

Dr. Edwin Fitch Northrup, vice president, Ajax Electrothermic Corp., Philadelphia, has been awarded the Edward Goodrich Acheson medal for 1931 for his work in developing high frequency induction heating. Dr. Northrup was born in Syracuse, N. Y., Feb. 23, 1866. He received his education at Amherst college, Cornell university and Johns-Hopkins university. And received a Ph. D. degree from the latter institution in 1895. Following three years in the West, he returned to Baltimore and became assistant to Prof. H. A. Rowland. From 1903 to 1910 he was secretary, Leeds & Northrup Co., Philadelphia, and from the latter year to 1920 he was assistant professor of physics at Princeton university. Since 1916, Dr. Northrup has devoted himself chiefly to the development of new methods of inductive heating. He placed the first practical high frequency furnace which he had designed in operation in 1917.

Dravo-Doyle Co., Dravo building, Pittsburgh, has been appointed exclusive sales representative in the Pittsburgh territory of the hoist and crane division, Robbins & Myers Inc., Springfield, O.

Budgeting for Profit In the Foundry

By C. E. Knoeppel

IN THE previous installment of this series of two articles, presented in the July issue of the THE FOUNDRY, an analysis of costs was made as a preliminary step to the work of budgeting. Costs were found to be of three kinds:

1—Costs of a purely fixed nature, like taxes and insurance.

2—Costs of a purely variable nature, like molding labor, salesmen's commissions and indirect labor.

3—Costs which have in them both a fixed part and a variable part, like advertising, foremanship and clerical.

A chart was presented to portray graphically the pernicious effect of these fixed costs on decreasing volumes. A *profit assurance* set-up of budgeted values per 100 pounds of castings, at 100 per cent of practical sales capacity, was determined upon as a basis for the balance of the treatment of the hypothetical case in question.

Considering the 100 pound values shown at the conclusion of previous article, and converting them into total costs and values at 100 per cent of capacity, the following will result:

Sales		$450,000
Profit	$60,000	
Fixed costs	48,000	
Fixed deductions		108,000
Balance for variable items		342,000
Metal cost	120,000	
Molding cost	90,000	
Coremaking cost	30,000	
Cleaning cost	30,000	
Variable overheads	72,000	
Total variable items		342,000
Balance		ZERO

The total of variable costs in the situation described in the preceding article was $64.00 per ton of castings. In the budgeted picture, without disturbing either the total fixed costs of $48,000, or the price of $75.00 per ton, we have total variable costs of $57.00 per ton ($342,000÷6000 tons at 100 per cent of capacity). This means a reduction of $42,000 or $7.00 a ton on 6000 tons.

Another chart has been made similar to the one schown as Fig. 4 in the previous article. An additional step has been taken by plotting a line representing the sales income, starting at zero. As will be seen in Fig. 5, the total cost line does not start at zero, but at a point where the fixed costs end, namely, $48,000. The line remains over the sales line up to a certain point. It then crosses the sales line and remains below to the 100 per cent capacity point. The cross-over or *neutral* point has been labeled the *PROFITLESS* point on the chart. Below this point losses are sustained, while above it profits are made.

On the chart presented as Fig. 5, that point is at 44.44 per cent of capacity, or 2667 tons yearly.

It may be recalled that the previous article stated the *neutral* point covering the costs as they were, was between 70 and 80 per cent, showing that costs were too high. The effect of budgeting a reduction of $42,000 in the variable costs, without reducing fixed costs any or lowering the sales price, plainly can be seen, particularly if one will visualize the cross-over point on the chart shown in Fig. 5 as between 70 and 80 per cent, in its relation to that shown, 44.44 per cent.

Incidentally, the formula for determining the profitless point is as follows:

$$\left(\frac{\text{Fixed costs}}{\text{Fixed costs}+\text{profits}}\right)\times \text{Budget point } \% = \text{Point of cross-over}$$

In this *profitgraph*, for any given per cent of capacity up or down the scale, we have a graphic budgeted profit and loss statement that is automatically variable.

Heretofore the discussion has been in terms of 100 per cent capacity. Since this is not a normal capacity, especially at this time, the budget has been made on the 85 per cent line, as representing a goal to shoot at. The budget might have to be set at 70 or 75 or 80 per cent, depending upon the local situation. Any one of these points is better under the budgeted arrangement, than the 60 per cent position illustrated in previous article.

On the 85 per cent line, the values, as set up on a profit asurance basis, are as follows:

Sales		$382,500
Profit	$43,800	
Fixed costs	48,000	
Fixed deductions		91,800
Balance for variable costs		290,700
Metal cost	102,000	
Molding cost	76,500	
Coremaking cost	25,500	
Cleaning cost	25,500	
Variable overheads	61,200	
Total variable costs		290,700
Balance		ZERO

At this point, please note the *DEADLINE* as shown on the chart.

Knows Foundries

ONE of the first jobs held by C. E. Knoeppel, author of this article and also the one which appeared in the July 1 issue of THE FOUNDRY, *was that of a laborer and molder in an iron foundry. Later he became a draftsman and designer and then worked in the office of the foundry.*

He started his professional work in 1905 as a systematizer, later becoming a cost accountant, industrial engineer and management counsellor. From 1914 to 1924 he was president, C. E. Knoeppel & Co. Inc., New York. In 1925 he became managing director, Waste Eliminators, Inc., Boston, and held that connection until 1928.

He has been a national director of the Society of Industrial Engineers, Chicago, and assisted greatly in the formation of that society. He assisted the Emergency Fleet Corp. during the war and also made a comprehensive investigation at that time covering the employment of women. He submitted a report to the first Industrial Conference called by President Wilson and the Unemployment Conference called by President Harding.

Mr. Knoeppel has published a number of books including the following: Maximum Production in Shop and Foundry; Installing Efficiency Methods; Graphic Production Control; Organization and Administration; Industrial Preparedness. His recent books are Profit Engineering and Man and His Work. As managing partner, Knoeppel Industrial Counsel, 1465 Arthur avenue, Lakewood, O., Mr. Knoeppel now is specializing in profit planning and control, waste elimination and human development.

For this hypothetical case we assumed capital investment to be $280,000. Invested in good stocks and bonds, it should by diversification and watching, earn 6 per cent annually or $16,800. This is the return for money, *as money*. The *deadline* is that point where the profit on sales income equals this return on capital investment, for it is only after that point is passed that the business earns profit, as a business. The additional is the reward for effort, energy, knowledge, experience and managerial ability put into the business.

It Pays To Budget

The difference between the budgeted picture and the one previously shown, at 60 per cent capacity, is that in the one case the return on investment of $16,800 is earned, while in the other the loss was $8400, a net change of $25,200.

By dividing the profit area into its components, namely, interest on borrowed capital, income tax, dividends, reserves, surplus, it is possible to develop points of capacity called *crisis*, *danger*, and *unhealthy* points, the meanings and locations of which, for the case in question, can be read from the chart.

Other such points can be indicated on such a chart, as for instance: Three to five year average, previous years results, where capital is turned once yearly, standard earnings requirement point.

Regarding the latter point, the author believes that as a premise, profit should range from two to three times a going rate on the capital employed in the business, as an average over a period of years. In other words, this would mean from 12 to 18 per cent yearly, with 15 per cent as the standard. That this may be hard to attain, perhaps impossible, is not the point, The important thing is to have a profit goal. Par of 72 in golf is not made every day, nor are bulls-eyes made large enough for all to hit them easily.

The *current position* line is a plotting based on the returns for the first quarter, indicating in this case, that the budget is not being realized. This position can be found from month to month for the year-to-date, and plotted on a photostated master *profitgraph*.

Total costs per 100 pounds of castings are shown by circled figures at each 10 per cent increment in capacity.

In the previous article it was stated that profit-making was as much a matter of efficient foundry practice and competent management as that of a technique of cost-finding, cost analysis and budgeting. As a matter of fact the latter is merely ways and means of measuring the former, both with reference to futures as well as covering the past and present. The one is historical, the other prophetic.

Management Is Involved

To step up the volume from 60 to 85 per cent, and reduce the variable costs by $42,000 at 100 per cent capacity, are problems involving foundry practice and management. Reference to the chart will show that the variable area *B* is the one which possesses the most potential, because it is the largest. That was the assumption in budgeting the cost reduction in question. The height of the fixed cost area *A* might be lowered by a scientific study of what makes fixed costs uncontrollable. The profit area at 85 per cent (even at 75 per cent) is large enough to warrant slight reductions in price if necessary

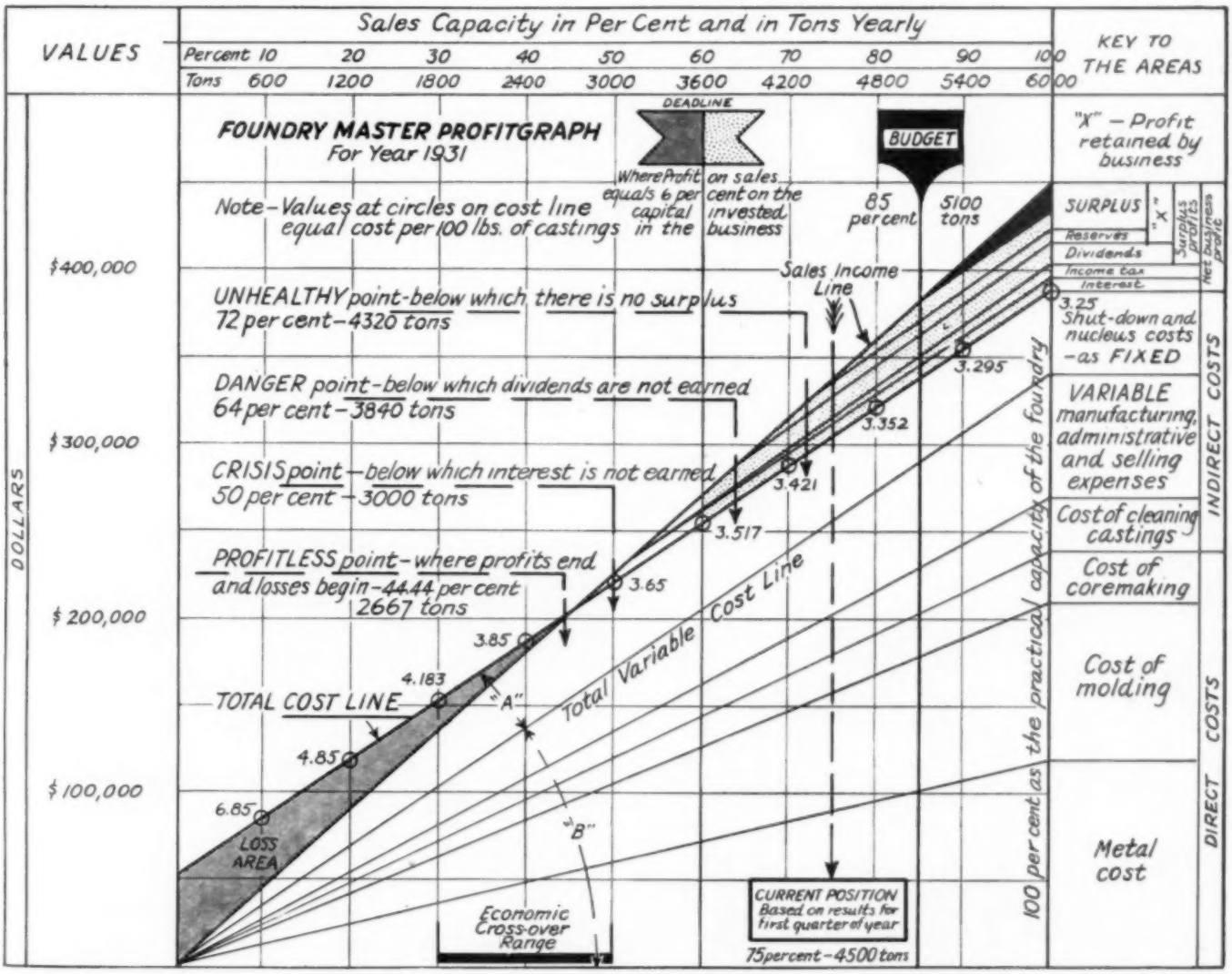


Fig. 5—The Profitgraph Gives a Graphic Budgeted Profit and Loss Statement Which Is Automatically Variable for Any Given Percentage of Capacity

to get additional volume. Certainly a business with a *cross-over* point between 70 and 80 per cent and operating on the 60 per cent line at a loss of $8400, has got to do something.

One of the many things that can be done is to provide what may be termed target practice.

Give 100 men rifles, without providing targets and tell them to shoot. No two men will shoot exactly in the same direction. But if targets are provided, and instructions are given in the use of the rifle and the effect of wind, and other things, all will in time hit the target and many will hit the bulls-eye. So it is with men in business. Put the matter of cost reductions before an entire personnel, by giving them facts, inferences and meanings of results, so that their minds will have something to shoot at, and it will be surprising what will be contributed in the way of valuable ideas and suggestions, especially if people are rewarded for hits.

There is no better way to find out why one has to do something, as a preliminary to ascertaining what to do, than to first portray actual results, as shown in Fig. 4 in the previous article, and then picture what these results should be, as shown in Fig. 5. It has been said that no man's knowledge is better than his facts. Certainly no one can tell what he is or not accomplishing unless he has some standards to measure accomplishment.

Efforts Are Rewarded

In several cases coming under the author's observation, the use of the technique described in these articles has resulted in efforts which were successful in bringing the *cross-over* point lower down on the capacity scale, and the widening of the profit area. More volume alone will not do this for as will be seen in the profit section, between 85 and 100 per cent capacity, the black area represents the additional profit due to additional volume, without widening the profit area or changing the *profitless* point.

There *is* efficient practice in the foundry business; it *has* men in it who are competent managers. All that this kind of management with right practice needs in many cases, to make a better job of it from the standpoint of a more successful business, is an engineering approach to the whole matter of profit-making.

Profits can be engineered the same as the right combinations of metals to make certain kinds of castings. The practice described herein is a good part of that engineering approach.

This is the second and concluding article on "Budgeting for Profit in the Foundry," by Mr. Knoeppel. The first article appeared in the July 1 issue.

THE EDITORS

Foundries Damaged by Storm

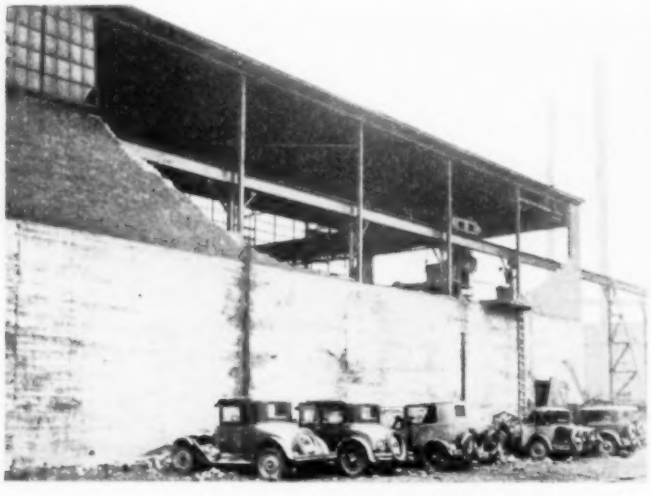
A 56-MILE-AN-HOUR gale struck Cleveland and northeastern Ohio June 26, causing over $2,000,000 damage. Cleveland suffered damage to the extent of a million dollars and foundries were not immune. The Interstate plant of the Ferro Machine & Foundry Co., 3155 East Sixty-sixth street, Cleveland, was damaged to the extent of $1500 when the wind wrecked a portion of the wall of the sand storage. The damage did not in any way interfere with the operations of the plant. Ten automobiles parked near the wall were damaged beyond repair.

The Nickel Plate Foundry Co., 14915 Woodworth Road, Cleveland, probably suffered most severely. Nine Mile creek, which is near the foundry, rose to an unprecedented height and flooded the plant, leaving a 2-inch deposit of yellow slime and mud throughout both the office and the plant. The water rose almost to the tops of the office desks. Men were stationed at all doors to keep articles from floating away. Nevertheless many were lost and the management four days later was looking along the banks of the stream 3 miles away from the plant in an effort to recover its property. The Nickel Plate Foundry Co. was unable to estimate the damage. One customer estimated his loss in patterns to be in excess of $10,000. All electric motors, except those located on the ceiling of the building, were out of commission. The compressors were damaged.

Although severely damaged, a few days later the foundry was operating at a limited capacity. Charles Bolich, manager, gave an interesting and typical foundry slant on the situation. The yellow mud that was deposited throughout the shop he thought would make fine loam when combined with sand. However, there was one drawback to its utilization, no sand was available at that time since when the water came in the sand went out.

Other foundries were damaged slightly by the loss of ventilators, windows and other minor items. The accompanying illustrations show the damaged section of the wall at the plant of the Ferro Machine & Foundry Co., and the exterior of the flooded Nickel Plate Foundry Co.

Carol Engineering Inc., designers and makers of sand conditioners has moved its main offices from Dayton, O., to 549 West Washington boulevard, Chicago.



Courtesy Cleveland Plain Dealer

Courtesy Cleveland Press

Fig. 1—A section of the Wall of the Sand Storage of the Interstate Plant of the Ferro Machine & Foundry Co. was Blown in. Fig. 2—Flooded Condition of the Nickel Plate Foundry Co.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

ALTHOUGH strainer gates of various types are employed extensively in American gray iron foundries, they are confined principally to small and medium size castings. Up to the present they have not invaded those foundries where large quantities of metal are poured into single castings. Great, open passages usually are provided for the rapid entrance of the metal. A whirl gate or skimming device of some kind serves as a safety factor. In many instances the pouring basin is made up in a special manner to prevent foreign material from entering the sprue.

Foundrymen whose attention has not been directed previously to the method will be interested in a system developed a few years ago in Italy by Cesare Brunelli, an Italian foundry engineer. General construction and application of the device to a chilled roll casting are illustrated in Fig. 66. The inventor worked out a set of tables governing the size and number of gates, also several modifications of the design, to suit practically all types of gray iron castings.

Reduces Oxidizing Effect

One of the chief claims made for this system of pouring the metal is that it does away with the necessity for providing any risers or feeders on large castings. This in turn eliminates the necessity of feeding or churning the metal with a rod. The inventor claims that the absence of risers and the use of this filter gate reduce the oxidizing effect of the atmosphere. The metal entering the mold (he claims) is oxidized in proportion to the volume of air with which it comes into contact.

Enlarging on this theory he claims that in molds with large open risers, a circulation of air is set up by the difference in temperature resulting from the pouring operation. This greatly increases the oxidation. Experiments have indicated that on a casting ¾-inch thick and with a single ⅝-inch riser, the air in the mold was renewed or changed 14 times during the pouring operation.

The foregoing merely is set down to indicate how widely foundrymen differ in opinion on certain points. Personally we do not hold with any part of the oxidation or circulation of air theory. Our views on this phase of the gating question were presented in previous issues of THE FOUNDRY particularly those appearing in the issues of March 1 and May 15.

In the illustration Fig. 66, the upper neck of the mold for the chilled roll is extended a short distance to catch any foreign material that collects on top of the body of metal rising in the mold. This section later is cut off and represents the only amount of metal that is wasted in the casting operation. It compares more than favorably with the large sink head and the long sprue extending from a basin at the top to a whirl gate at the bottom, employed in ordinary roll casting practice. The system appears to have several commendable features.

Two foreign type pouring basins, rather more elaborate than usual are shown in Figs. 67 and 68. They are presented as types rather than examples to be followed slavishly in every detail. They are designed for use on special occasions when every precaution must be taken to produce a casting perfect in every respect.

With one or two slight changes, either one of these runner basins might be formed from a core sand mixture in a corebox. In the examples shown, special cast iron boxes are lined with loam and dried. Usually loam molding and dry sand molding methods are employed extensively in the foundries where this style of pouring basin is found. Therefore the loam and the men accustomed to its manipulation are available. The job is not entrusted to a helper. The runner basin is made up by the molder and receives the same care and attention as any other part of the mold.

Flowing Iron Is Cleaned

The runner basin shown in Fig. 67 is made up of a cast iron box with rounded ends and divided into four compartments. Each one of the compartments affords the scum a chance to float on top of the molten iron. After the iron thus has had four chances to rid itself of foreign inclusions, it is reasonable to assume that it is clean when it flows down the sprue at the end of the basin farthest from where it fell from the ladle.

A certain amount of iron is held back by the first baffle while the remainder flows under the baffle plate and into the second chamber. Here a low baffle on the bottom of the basin imparts an upward motion to the iron and assists any foreign material in floating to the top. The treated iron then flows under the second baffle into the third chamber and from there under the third baffle into the fourth chamber. From the fourth chamber it is discharged through the bottom into the sprue leading down to the mold cavity.

A slightly different method of cleaning the iron is illustrated in Fig. 68. Centrifugal force imparted to the metal in two chambers before it reaches the exit over the sprue, is relied upon to separate the foreign material, if any, from the iron. This foreign material floats on the center of a whirlpool while the clean iron

Strain the Metal

DESCRIPTION of a strainer system for pouring large castings in an Italian foundry is followed by reference to two types of elaborate pouring basins employed in certain European foundries to insure a thorough cleaning of the molten iron before it enters the sprue. The pouring basin is recognized as an exceedingly important part of the mold and its preparation neither is slighted nor delegated to an inexperienced person. Many advantages are claimed for a patented type of runner basin and gate, developed originally for use on chilled cast iron car wheels. Tiles or brick sleeves are not used as extensively for gates and runners in the gray iron foundries as they are in steel foundries, due principally to the fact that the service is not so severe and dry sand cores offer an easily made and economical substitute.

continues on its way. The arrows indicate the direction of flow. This runner box is made up of three chambers with the second smaller than the first and the third smaller than the second. This formation assists the pourer in keeping the basin filled with molten iron.

Pour Car Wheels

An improved type of pouring basin and strainer gate particularly applicable to the molding of car wheels, but which may be adapted for use with many other castings, is shown in the Figs. 70 and 71. This device, one of the exceedingly small number to fall in that category, was patented in 1920 by W. J. Alford, Birmingham, Ala. The inventor claimed that he had introduced it into several car wheel foundries and that as a result, or rather as one of the results, the chipping expense in these shops had been reduced by 75 per cent.

Other claims advanced for the device include the elimination of the collar core and dry sand basin and the practical insurance of a solid hub. Time saved enables the molder to put up two or three aditional wheels per day. The amount of metal in the pouring basin is reduced to approximately 20 pounds. The entire saving in cost on each wheel as compared with former methods amounts to between 10 and 13 cents.

The device consists essentially of two parts, the top print on the center core for the wheel and the hollow plug shown at the left in Fig. 70, which the sand in the pouring basin is rammed against. Details of construction of the core print and plug for making the pouring basin are shown in Fig. 70 while the application of the device is shown at the right in Fig. 71.

The core print is provided with three projections on the edge which leave three gate openings around the top of the center core after the mold is closed. The top of the center core also forms the bottom of the pouring basin. The plug shown at the extreme left in Fig. 70 and used as a pattern in forming the pouring basin, is fluted on the outside at three points to coincide with the three projections on the center core print. These flutes do not extend all the way up the side of the plug. They commence full size at the bottom and gradually taper away to nothing at the point where they merge with the circular form of the plug.

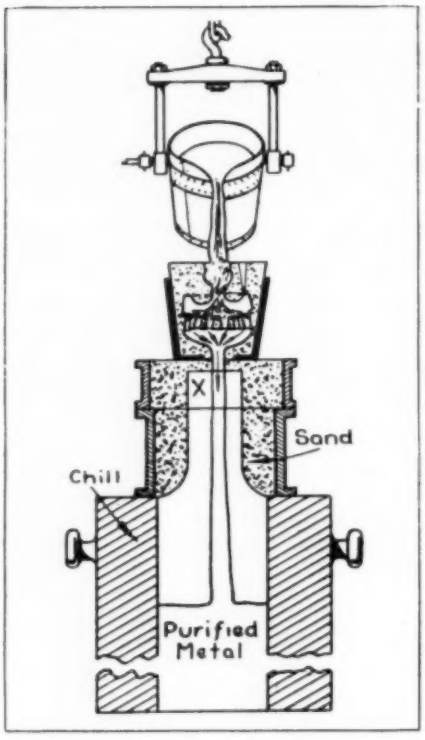


Fig. 66—Strainer Core Applied To Pouring Basin on Roll Casting

The top center core print is provided with the usual type of dowel on the under side which fits in a corresponding dowel hole on top of the wheel pattern. The upper side of the print contains a triangular recess for the reception of a corresponding triangular projection on the bottom of the pouring basin plug. This special shape dowel locates the plug accurately on top of the print in relation to the projections on the side which form the gates. Of course three gates are not mandatory. They just happen to suit the job for which they were designed. Under other conditions and with other types of castings, the number and size of the gates might be arranged in a wide range of variations.

Use a Metal Form

Each gate in the particular set shown in Fig. 71, is narrow in cross section, only ¼-inch, and therefore involves no work in the chipping department. The gate ensemble is knocked off with a hammer before the wheel is taken to the annealing pit. Later, any small stump remaining is removed while the wheel is on the boring mill or in the lathe.

A wood plug will serve satisfactorily and will last for a considerable time where this type of gate and runner are required only occasionally. Where the device is in constant use, it is formed either from a piece of steel plate rolled and welded, or, from a casting of the metal usually poured in the shop. Thus it may be cast iron, brass, aluminum or steel. The outside is finished and polished, the top is covered with a thin plate to prevent the entrance of loose sand and a handle is attached to the top. Minor variations in design and con-

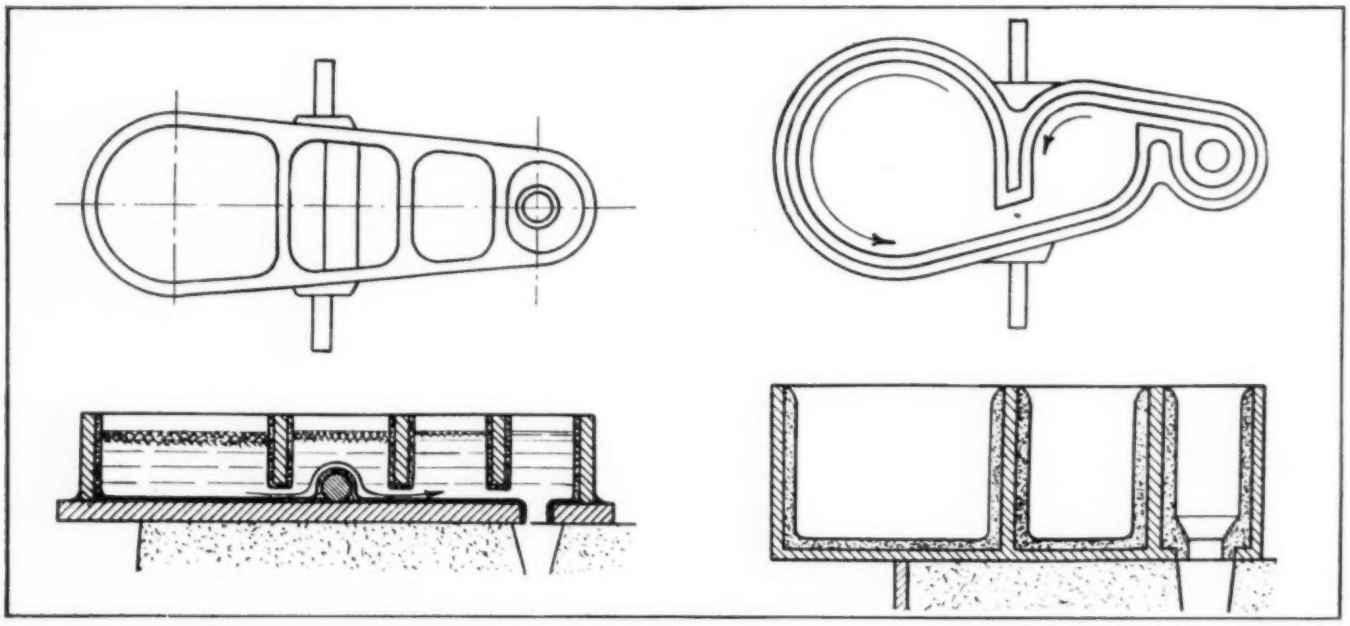


Fig. 67 (Left)—In This Type of Skimmer Basin the Metal Passes Under Two or More Baffle Plates. Fig. 68 (Right)—Centrifugal Force Skims the Metal in This Type of Runner Basin

struction will occur to nearly every man when he sets out to adapt the device to his own use.

Foundrymen may be divided roughly into two main classes. One copies a design, a method or a process so faithfully in every detail, that sometimes a palpably faulty feature is included. The second class never is satisfied. The first class forgets nothing and learns nothing. The second class never ceases its search for improvement and gladly welcomes the opportunity of trying something new. Members of the second class burn their fingers occasionally, but they have the satisfaction of knowing that they are responsible for all the progress that has been made in the art of casting metal.

Tiles Are Used

Although not used as extensively as in the steel foundry, tiles are used for gates to some extent in the gray iron foundry, particularly on large molds. These tiles are similar in general features to the sleeves which encase the stopper rod in the ladle employed for pouring steel. They may be had in various sizes and in the majority of cases the cost compares favorably with that of the dry sand cores usually employed for the same purpose. The determining factor usually is the freight rate, based on the distance which separates any given foundry from the source of supply.

Tiles are provided with a male joint at one end and a female joint at the other end and therefore may be built into the sand surrounding the mold cavity with every assurance that they will maintain a clean, dry, open passage for the metal later. Special tiles are provided with openings in the side for the conversion of the vertical into a horizontal stream of metal. Typical vertical and horizontal tiles are shown at *A* and *B*, Fig. 69. Out of the original list of gates set forth in alphabetical order in Part III of the present series of articles, published in the Feb. 1 issue of THE FOUNDRY, only four remain to be described: Top gates,

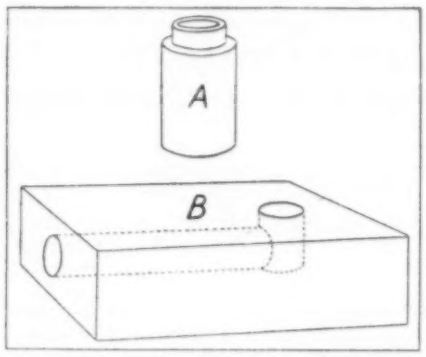


Fig. 69—Straight Tiles and Special Connections Are Used To Form Gates on Large Castings

wedge gates, whirl gates and whistlers. Some reference to each and all of these has appeared in connection with other types.

For example, top gate merely is another name for pop gate or pencil gate. This type of gate has a wide application and probably would be employed even more extensively if more attention was paid to the sand. In some instances a top gate has been condemned and changed to another type through no inherent fault of its own, but because the sand in the vicinity was not sufficiently refractory or sufficiently well bonded to resist the temperature and erosive action of the falling metal. Many castings that now are gated at the sides or ends might be gated advantageously on the top.

This applies particularly to long pipes and columns poured horizontally. In the majority of instances these castings are gated either at one or both sides, or, at one or both ends. In either case the flask has to be made considerably wider or longer than the casting to accommodate the gates and runners.

Gate Introduces Hazard

A long runner attached to many branch gates along the side of the pipe or column mold introduces a hazard which has to be experienced to be really appreciated. Probably more pipe castings are lost through leakage of metal in this area than for any other single cause. Unless the flask is unusually rigid and well secured and unless the sand is exceptionally well rammed in the vicinity, the molten iron will force a way out at the joint behind the runner. Even if the casting is saved through heroic remedial measures, an unsightly fin will have to be chipped from the greater part of the joint line. Usually also in cases of this kind, the casting will warp more or less out of a straight line on account of a shift in the core which destroys the uniformity of the metal thickness.

All this hazard may be avoided and a smaller flask may be employed where several top gates are substituted for the gates at the joint line. A long basin on top of the cope delivers metal to the various small top gates and a small riser at each end indicates when the mold is filled. By cutting the metal short when it appears in the riser, hardly any metal will remain in the runner basin. A light tap from a hammer will knock each gate stump from the casting and eliminate practically all chipping.

A wedge gate is a species of top gate usually applied to thin castings

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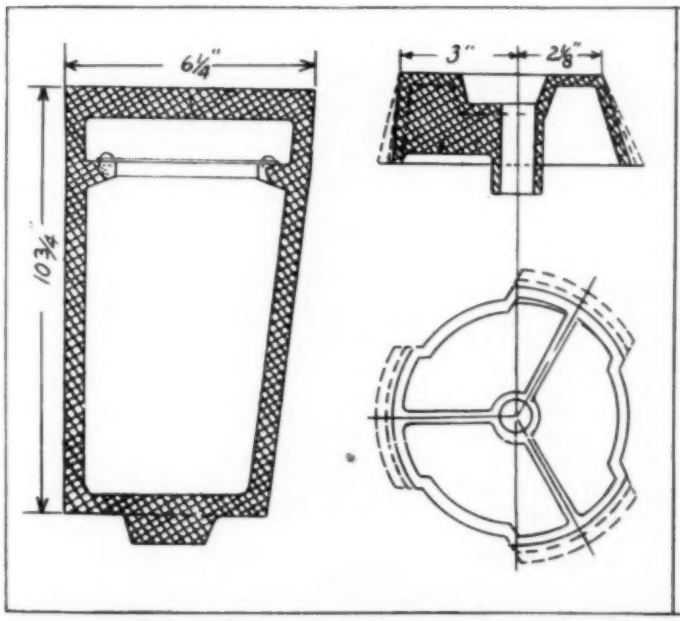


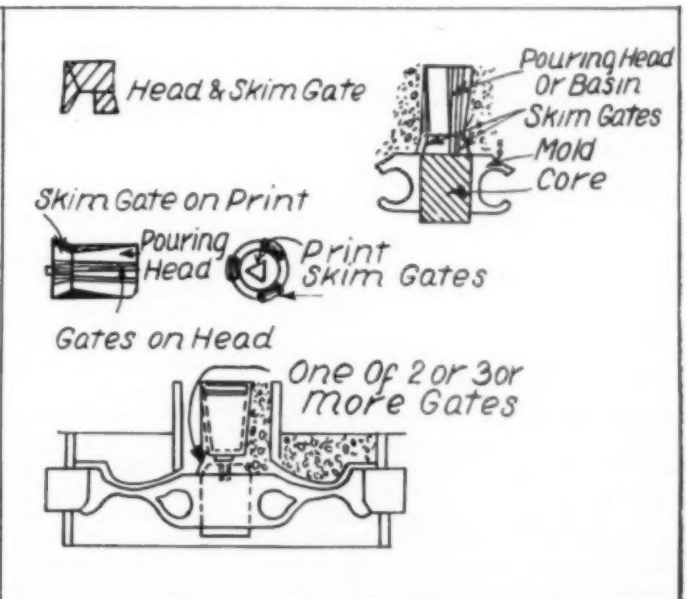


Fig. 70—Sectional and Plan Views of Runner Block. Fig. 71—Showing Detail of Special Runner Block and Method of Application on the Hub of a Chilled Cast Iron Car Wheel

Malleable Industry Needs

CO-OPERATIVE EFFORT

Constantly Increasing Complexities of Business Make the Trade Association a Fundamental Necessity

By Herman H. Lind

General Manager, Malleable Iron Research Institute

WHILE many industries are in relatively better position today than the malleable iron industry, there are many much worse. Only courageous effort now can prevent the malleable industry getting into the category of the worst.

No industry can ascertain its own position and chart its course properly without close study of the general business situation. That is peculiarly true of the malleable iron industry, because, in the last analysis, it is a service department to other industries.

It can take a page from the books of many other industries that for years have been able to earn little if anything on invested capital, because of over-production and cut-throat competition. We might mention the textile industry, leather, copper, raw sugar, all among the major industries, that are just beginning to act on a realization that they cannot beat the law of supply and demand. In many cases, the greater the demand, the more to be lost by unwise increases in production capacity. The experience of these great basic industries provides a lesson for the malleable industry to heed.

Business a Contest

Ours is a business of free competition and free competition is in reality a contest. For the good of an industry, and for the good of the public, it should be so considered. Any contest must adhere to certain fundamental rules for its own protection, and for the benefit of the public. No one should want more than a fair chance, and everyone should demand that. When the use of a referee is impractical, as it is in business competition, then it becomes a matter of self government from within the industry.

The ultimate ideal of a trade organization is to establish a condition whereby each unit of the particular industry the trade association represents sees clearly and accurately the situation within and without and can determine the proper procedure to be followed by looking at the picture through the same glasses. Only when every unit in an industry knows that every other unit sees as it sees, and acts accordingly, will sane balancing of capacity to need be approached. The greater the percentage of an industry contributing to the collection of facts, the more accurate are the facts, and the more useful.

Gathering and dissemination of statistics is to show the actual existing condition so that the businesses can plan the courses from generally known facts.

While the trade organizations can gather, compile, and disseminate statistics, it cannot interpret them as an industry. Interpretation can be done legally only by the individual foundries. Unselfish facing of the facts should point to the correct interpretation and actions for anyone who will take the time to study them.

Business Heads Responsible

Responsibility of following the course that is indicated as the most intelligent rests solely with the heads of great and small businesses. That is what self-government means, and an industry that cannot properly govern itself in the right channels will pass its portfolio to one that can.

The fundamental necessity of the trade association grows out of the inability of the individual to know and cope with the economic and business problems arising from the constantly increasing complexities of business and the widening of markets through the development of new products and processes.

One of the greatest needs in business now is more intelligent planning for the immediate and distant future, and how is it possible to do intelligent planning in an industry, such as the malleable industry, without bringing to a common focus the minds of the leaders of the industry? Without co-ordination, the value of best laid plans are neutralized.

The complexity and ramifications of business, if not brought to a common point for observation and study, result in the kind of ideas existing as were described by John Saxe in the short poem "The Blind Men and the Elephant" from our treasured Fifth McGuffey's reader:

It was six men of Indostan,
To learning much inclined,
Who went to see the elephant,
Though all of them were blind,
That each by observation
Might satisfy his mind.

The first approached the elephant,
And, happening to fall
Against his broad and sturdy side,
At once began to bawl:
"God bless me! but the elephant
Is very like a wall!

The second, feeling of the tusk,
Cried: "Ho! what have we here,
So very round, and smooth, and sharp?
To me 't is very clear,
This wonder of an elephant
Is very like a spear!

The third approached the animal,
And, happening to take
The squirming trunk within his hands,
Thus boldly up he spake:
"I see," quoth he, "the elephant
Is very like a snake!"

The fourth reached out his eager hand,
And felt about the knee:
"What most this wondrous beast is like,
Is very plain, "quoth he;
" 'T is clear enough the elephant
Is very like a tree!"

The fifth, who chanced to touch the ear,
Said: "E'en the blindest man
Can tell what this resembles most:
Deny the fact who can,
This marvel of an elephant
Is very like a fan!"

The sixth no sooner had begun
About the beast to grope,
Than, seizing on the swinging tail
That fell within his scope,
"I see," quoth he, "The elephant
Is very like a rope!"

And so these men of Indostan
Disputed loud and long
Each in his own opinion
Exceeding stiff and strong,
Though each was partly in the right,
And all were in the wrong!

An association's interest is in furthering the progress of the individuals in the industry, through scientific research, standardization, statistical activities, sales promotion, and similar work. It is also interested in discouraging and eliminating unfair practices of various kinds.

Co-operative effort is not intended to and never will take the place of individual work. Nevertheless it will intensify the work and multiply its effectiveness. This applies to any activity undertaken.

Trade Abuses Follow

Uneconomic or abusive acts force the adoption of similar abuses by competitors in self defence, and then one trade abuse follows another. No one company or group of companies has a corner on selfish, unfair, and sometimes actually dishonest practices. In the end, the cost of these practices take a larger toll of the profits and then goes on to add more to losses than does the entire overhead.

It is a well recognized fact that in normal or good business periods a small part of an industry, through unethical or uneconomic practice can and does cause loss of confidence in the integrity of the entire industry and its product.

In periods of low business, a still smaller percentage is more potent as a destructive element adding to the distress caused by general business conditions.

Any company which in times like these thinks it can, through unwarranted low prices, buy its way into business sufficient to run substantially above the average percentage level over anything more than a most limited period is fooling itself. Such tactics reduce the average price but do not get the volume. The company has burned the candle from both ends for its own business and has promoted a condition in the industry that comes back to the particular company with increased intensity.

The inexorable laws of economics will drive out the inefficient without a dog battle for the survival of the fittest. The battle of the survival of the fittest too often ends with no one fit.

The sales problem of our industry is not only competition between plants but competition between industries. While every possible energy should be used in getting into malleable iron every item that belongs to malleable iron, by reason of being better or cheaper, or both, we should not take business that is better in another material, for that would be a boomerang even beyond the immediate item.

There is a large undeveloped field in new and extended uses for malleable, and creative sales work can well be undertaken aggressively. It is much better to create new business than to go gunning for business from present buyers of malleable who have had satisfactory product and service from another connection over a long period of time; for that in effect is attempting to take something from someone who feels as though it were his property, as though it belonged to him.

If the original seller loses the business, on a basis he cannot afford to meet, he feels he is forced into active reprisal or at least picking up some other business by similar tactics. The endless chain is under way to the ruination of confidence, goodwill and business judgement; and with it comes elimination of profits and encroachment on capital invested in the business.

On the other side, a word of caution in believing all the bad one hears

Herman H. Lind

might not be amiss. These are jumpy periods for the nerves and stories of ridiculous judgement and acts sometimes are exaggerated unintentionally, and sometimes misunderstood. Frequently, a situation would be thought of in a different light if all the facts of the case were known.

The position of the sellers of materials of the type we manufacture has changed in the past few years. The number of outlets for a given tonnage in some industries is substantially reduced. When the seller is face to face with a large buyer today, he naturally feels the extreme necessity of getting that particular business, or at least a portion of it for he does not feel that he can go to ten or 20 other places to get his share of the equivalent tonnage, as was the case years ago.

Therefore the extremely large corporations also have a responsibility which they should assume along with the advantages accruing to them by reason of their size. If they really desire to maintain a prosperous ultimate market through the present wage structure, it devolves upon them to see that in these days of extreme competition, the low costs of material they buy is not made possible only as a result of inadequate wages paid for the production of the material.

Evidence is coming to light that this attitude is being taken by some buyers, for in our own line of business cases have recently been called to our attention in which the buyer has questioned the seller carefully as to his ability to make a fair return at the prices quoted. In some instances, business has not been placed with the low bidder because the buyer has ascertained that the quotation was below efficient cost.

It is evident that the character of our material is good and is improving. Plant executives in foundries are doing the kind of a job that permits officials to concentrate their time on what is now the more important field *merchandising the product*. When we speak of merchandising the product, we mean the kind of selling that produces orders at a commensurate profit.

The effort to sell a meritorius product on the merit that it will render a special service to the buyer, carries with it almost without exception a determination to get a price in keeping with good business judgement.

Without profits obviously the units and the industry cannot be prosperous, and an industry that its not prosperous cannot fulfill its mission to its community, to its customers, or to its stockholders.

Surprisingly few complaints have been made during the past year on quality of material. In fact, one could not be closely associated with the industry looking at it as a general picture without becoming firmly convinced of the fundamental usefulness of the material and the real desire of the industry as a whole to produce it of a high and uniform quality. This is a solid foundation on which to build.

To be used, the possible users must be made to know about the product, and in this day that cannot be done by simply sticking out a sign *Malleable Iron Castings*.

Must Know Castings

The methods used in selling trade mark and patented specialties do not seem to fit the methods required for malleable iron but the planned and directed energy which is used in that connection does fit.

Sales activity must be carried into the engineering and operating departments of the possible users. So far as possible that must be done by men who know their castings, who are able to give the engineer, the designer, and the operating man the kind of information that is helpful to him. The designer always has plenty of

troubles. The man who helps him solve a problem is doing him a distinct favor, and the designer realizes it whether or not he tells the foundryman about it.

We need a new understanding of the word *Service*. Surely it is delivering the goods to fit the customer's order in time and quality, and that is being done consistently. In the larger and more important sense it is giving the user and potential user the benefit of special and intensive knowledge of the material produced that it may be made to fit his needs the better. It is educating him in additional uses of malleable casting.

Our industry has a serious problem. Granted that fundamentally it is a good industry, it is a problem worth solving. There is a political adage that applies, "The greatest of obstacles make the greatest of stepping stones," and our obstacles today are lack of cohesion and co-operation in going forward with constructive work, and in eliminating destructive forces.

When our industry realizes that co-operation is not an academic thing intended only for the other fellow, but that it is a vital necessity, for each executive and his company to practice personally, that each executive must work unselfishly, and consistently spread his influence by example and by word, then a new day has dawned for malleable iron to come into its own.

Must Have Profits

WITHOUT profits, obviously the units and the industry cannot be prosperous and an industry that is not prosperous cannot fulfill its mission to its community, to its customers or to its stockholders. This, according to Mr. Lind, is one of the important reasons for co-operative effort through trade associations. This article is abstracted from a paper presented at the meeting of the Malleable Iron Research institute at Chicago, June 26.

Malleable Group Stresses New Uses

A MEETING of the Malleable Iron Research institute was held at the Stevens hotel, Chicago, Friday, June 26, at which 75 members and guests participated in a discussion ranging from business practices to the latest developments in research and technical control. Dr. Enrique Touceda, Albany, consulting engineer for the institute, reported upon contemplated changes in specifications which will raise the physical properties. He noted that the symposium on malleable iron castings prepared under the joint direction of the American Foundrymen's association and the American Society For Testing Materials, which was presented before the latter association at the afternoon meeting, represented malleable properties only to a limited extent. In other words, the physical valuations given represented what has been done and not what can be done in producing high quality material for special service. Dr. Touceda strongly advocated developing higher properties and then creating a demand for the product upon the basis of these higher properties. He reviewed briefly an investigation on the causes of checks on test bars and other detailed research activities which are going forward.

Projects Now Under Way

R. J. Teetor, Cadillac Malleable Iron Co., Cadillac, Mich., chairman of the research committee of the institute, told of projects now under way at the University of Michigan covering the machineability of malleable cast iron. A further research on the factors of effecting short cycle malleableizing which is being conducted jointly with the American Gas association also is under investigation at the University of Michigan, with the institute supplying test bars. A proposed investigation of the effect of pig iron upon certain troubles encountered in making malleable castings also was reported. Mr. Teetor noted that individual research activities are being carried on at various shops of the institute with the operating men in charge. A market research is tied in with these activities and Mr. Teetor cited the recent acceptance of malleable on certain railroad specifications as an example of the application of market research developments. He advocated a larger financial program to carry on this work.

Harry W. Highriter, Cleveland, shop practice engineer for the institute, reported seven co-operatitve research projects now under way under the shop practice division of the institute. These cover special irons, the investigation of causes of frame structure, dimensional variations, improvement in melting control and various fundamental principles in design of malleable castings.

Ralph N. Cole, Canton Malleable Iron Co., Canton, O., chairman of the western section activities on development of new uses, stressed the need of contacting engineers in customer organizations. The development of new uses of malleable where factors of strength, less weight, low cost, corrosion resistance or appearance are important, in many instances involves redesign and the problem of the malleable manufacturer is to reach and educate the designing engineer. He cited cases of substitution of malleable for other products which have been made upon the basis of better service from malleable castings. These included small hand tools, cases for gasoline pumps where corrosion is a factor, washing machine parts, sanitary ware, etc.

E. E. Griest, Chicago Railway Equipment Co., Chicago, chairman of the committee to promote railway sales, mentioned the readmission of malleable iron in railway specifications, a recent activity of the institute. One step resulted in securing some 2600 tons of railway car side stakes. Mr. Griest warned against holding back on exploitation to await higher specifications. The effort constantly should be made to educate the consumer on the uses and advantages of malleable castings.

A report upon the statistical service of the institute, outlining some new undertakings of definite value, was presented by Robert E. Belt, secretary-treasurer.

Herman H. Lind, general manager of the institute, stressed the courageous effort necessary to maintaining industry under present conditions. The malleable castings branch of the foundry industry necessarily is a service department to other industries. Under present conditions of competition, self-government through a trade association is doubly necessary. Mr. Lind stated that the need of creatitve sales work is particularly evident in the malleable industry. The effort to sell a meritorious product of service to a buyer always carries a profit to the vendor and this point particularly is imperative at present.

At the luncheon meeting which followed, Dr. Frank M. Surface, bureau of foreign and domestic commerce, department of commerce, Washington, spoke on the fundamental lessons which the present business depression is impressing

Iron Duty Unchanged

President Hoover has approved the findings of the tariff commission which indicates that no change should be made in the duty on pig iron of $1.12½ per ton.

Chain Belt Co., Milwaukee, has moved its Buffalo office from 753 Ellicot square to 1807 Elmwood avenue. T. E. Cocker is district manager.

Outlines Methods for Making

HIGH-TEST GRAY IRON

In the Shop Making Machine Tool and Jobbing Castings

By L. M. Sherwin and T. F. Kiley

SOME of the castings made in nickel-treated regular iron mixtures are illustrated in Fig. 6. The main purpose of nickel in these castings is to aid machinability. As an indication of the size of the castings, *D* is 7 inches long.

The casting shown at *A* is a meter cover which when poured with mixture No. 4 (Table III in the July 1 issue of THE FOUNDRY) tended to come hard on the tips of the inner projections and at extremities of the outer projections. Ferrosilicon to 1.25 per cent was first tried as a means of further softening the iron going into these castings, but resulted in a peculiar shrink hole or draw at the base of one or more of the inner projections, similar to the draws often noted when iron is low in carbon or poured with insufficient head.

Fig. 4—Iron From Mixture No. 1, Table III, Etched in 2 Per Cent Nitric Acid in Alcohol, X500

Alloys in Iron

NICKEL added in varying proportions increases the machinability and takes the chilled edges off many castings. This applies particularly to castings in which the total carbon and silicon contents have been lowered deliberately to increase the density of the metal. Chromium is added to the iron destined to be poured into castings subjected in service to high temperatures or severe abrasion. Chromium treated iron also resists growth when subjected to continuous high temperature or to alternate periods of heating and cooling. This is the last of two articles, abstracted from a paper presented at the Chicago convention of the American Foundrymen's association. The first installment appeared in the July 1 issue of THE FOUNDRY.

Nickel to 0.5 per cent overcame this hardness without resulting in draw.

The pump casting shown at *B*, requires a dense and close-grained iron which must machine readily. Mixture No. 1 (Table III), with a ladle addition of 2.25 per cent nickel gave the required properties. A refrigerator piston is shown at *C*, requiring a strong, good-wearing iron which must machine readily. Mixture No. 1, with a ladle addition of 2 per cent nickel, gave the required properties.

The protractor casting shown at *D* has very thin edges (1/16-inch) which have to be milled. This casting came hard when poured with mixture No. 4 (Table III), and ferrosilicon additions resulted in rejects due to small gas holes. Mixture No. 4 with a ladle addition of 1 per cent nickel stopped the hardness without gas holes resulting.

A traveler casting, shown at *E*, has thin edges and is subject to severe wear in recess. Mixture No. 3 (Table III) with a ladle addition of 2 per cent nickel gave the wearing quality desired with satisfactory machinability of the casting illustrated.

A typewriter casting, illustrated at *F*, is deeply and closely slotted for operation of key levers. These slots must be free from any trace of porosity. The thin skirt adjacent to the body of the casting is slotted, and also the knife-like edges on parts of castings. When poured with an iron close enough to overcome porosity in the body of the castings, caused by draw from the skirt, the knife-like edges were chilled white. Reversing the position of the pattern in molding, locating two of the thin points in the drag, gating in at two other thin points and pouring wih mixture No. 1 with a ladle addition of 1 per cent nickel, produced a sound casting without chilled edges.

The casting at *G* is a cone pulley which, when poured with iron close enough to overcome porosity in the

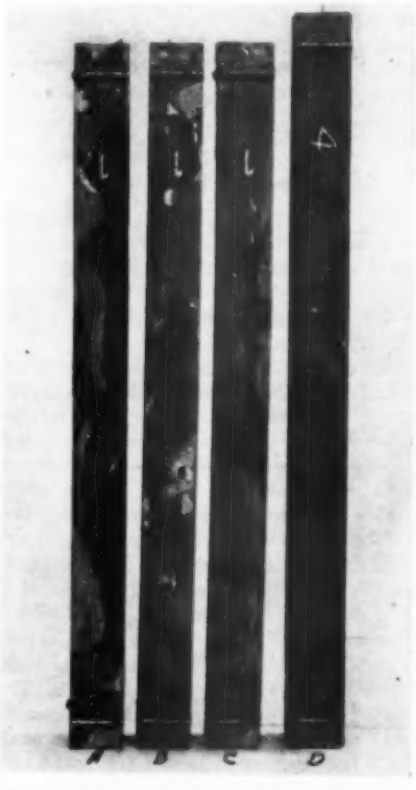


Fig. 5—Chromium Prevents Growth As Shown in Bars A, B and C. Bar D Was Untreated

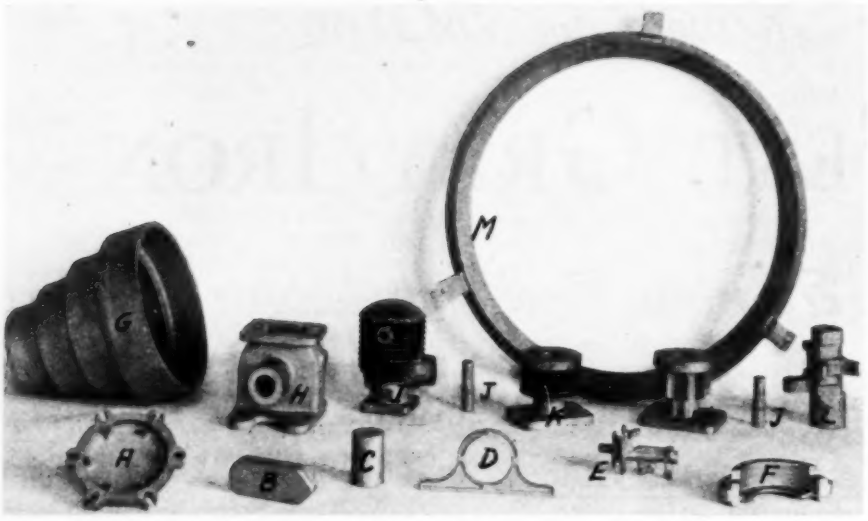


Fig. 6—High Test Iron Castings From Mixtures Shown in Table III with Nickel Added in the Ladle

corner of steps, resulted in hardness on the rim at the large diameter end. The casting is made with this end up, and iron flows up last at this point. Mixture No. 3 with a ladle addition of 1 per cent nickel resulted in a casting sound at the corner of steps and which machined satisfactorily on the rim.

The casting at *H* is a refrigerator compressor base. Iron sufficiently close to overcome leakage between various sections was hard or chilled while at other sections. Mixture No. 1 with a ladle addition of 2 per cent nickel overcame this trouble.

The casting at *I* is a lighting-plant cylinder. It came hard when poured with iron close enough to overcome a shrink hole showing up on machining and due to an adjoining thin and heavy section. Mixture No. 3 with a ladle addition of 1 per cent nickel produced a sound casting free from hardness.

Gets Good Casting

The tappet guide, *J*, *J*, is subject to severe wear and had to be of very close grain and hard, yet machinable. Mixture No. 3 with a ladle addition of 2 per cent nickel resulted in a satisfactory casting.

K and *K*[1] illustrate two castings both of which came chilled or hard when poured with an iron mixture close enough to stop a large percentage of leaking castings. Mixture No. 1 with a ladle addition of 2 per cent nickel overcame this trouble.

Iron close enough to overcome porosity in the cored center hole of casting *L* resulted in extremities of the thin curved section coming very hard. Mixture No. 1 with a ladle addition of 2 per cent nickel gave a sound casting free from hardness.

The ring illustrated at *M* is a casting used in textile work. A curved deep slot is cut into the ring, and at locations adjacent to the bosses castings frequently were found porous. Mixture No. 1 with a ladle addition of 2 per cent nickel resulted in a sound casting without machining difficulties.

In this foundry most chromium-treated castings are of white fracture, nonmachinable and in use are subjected to high heat or to severe wear. This iron is produced by adding 1 to 5 per cent powdered ferrochromium at the spout to mixture No. 1, Table III. A typical analysis of product is: Silicon 1.80 per cent, sulphur 0.13 per cent, manganese 0.80 per cent, phosphorus 0.22 per cent, total carbon 3.25 per cent, combined carbon 2.80 per cent.

Enough ferrochromium is added to produce a white fracture throughout. Such irons tend to pipe badly if the design is at all difficult. External shrinkage often develops in corners or at the junction of varying sections when chromium is high. This is overcome ordinarily by a reduction of chromium, or sometimes by a change in design.

Fig. 7 illustrates castings poured from this type iron. As an indication of the size of the castings, *A* is 30 inches long. The casting in the foreground *A* is a rail spreader for an annealing furnace. Mixture No. 1 plus 5 per cent ferrochromium, gave the property desired, namely, resistance to heat. The castings *B*, *B*, *B*, are sand-blast nozzles subject to severe wear. Mixture No. 1 plus 3 per cent ferrochromium gave resistance to wear.

Castings Resist Wear

The circular piece *C* used in grinding cocoa is subject to severe wear. Mixture No. 1 plus 5 per cent ferrochromium, using dry-sand mold, gave resistance to wear. The segment *D* is a section of a cocoa grinder. Mixture No. 1 plus 3 per cent ferro-chromium, using dry-sand mold, gave resistance to wear.

The remaining castings in Fig. 7 are oil-burner parts, subject to high heat. Mixture No. 1 plus 1 to 5 per cent ferrochromium gave the property desired.

Chromium is a powerful agent in preventing growth, as is evident from Table VIII. The soft untreated iron grew five to seven times as much as chromium-treated iron. Fig. 5 illustrates the difference between three bars of chromium treated iron (*A*, *B*, *C*—chromium treated, mixture No. 1, Table III) and one bar of untreated iron (*D*—plain iron, mixture No. 4, Table III).

High-test and alloy cast irons should be of assistance to the foundry industry in promoting quality in certain difficult classes of work. The manufacture of castings from high-test irons requires considerably closer attention to details in melting, molding and pouring than with usual grades of gray iron and semisteel mixtures.

There is a rapidly expanding market for castings having superior or special qualities, and the posibility of producing such castings should do much in advancing the gray iron industry. The production of high-test castings results in higher costs, due to the necessity of using more expensive materials, more expensive molding methods, lower fuel ratios and a high proportion of foundry returns to good castings produced.

Castings of high-test iron do not machine quite as readily as do the usual grades of iron. They offer more resistance to tool penetration but are

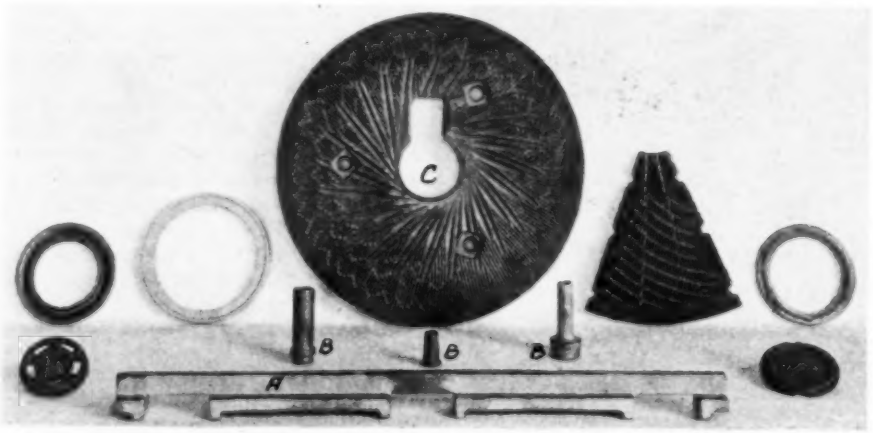


Fig. 7—High Test Iron Castings From Mixtures in Table III *with Ferrochrome Added To Resist Heat and Wear*

free from hard spots or structures that would ruin a tool, if such irons are properly made and poured into castings of proper sections. Dry-sand-molding generally must be followed in the production of high-test castings, to insure sound, clean and good-surfaced castings.

The slight variation in hardness from the outside to the center of the arbitration bar is noteworthy and a high tribute to the homogeneity of high-test iron. Deflection values of high-test irons are lower than the usual grades, unless alloys are used. Solid contraction (pattern-makers' shrinkage) in high-test iron is considerably higher than in the usual grades of iron.

In general, graphite is finer and more uniformly sized and distributed in high-test iron than in the usual grades of iron. Transverse and tensile strengths are considerably higher in high-test iron than in the usual grades of iron, and tend to be at a maximum at the eutectoid point.

High-test iron is invaluable in overcoming internal liquid shrinkage, sponginess, draws between adjoining light and heavy sections or porosity in castings of difficult design. External liquid shrinkage is much greater in high-test iron than in the usual grades of iron, necessitating the use of large risers to eliminate surface depression.

Nickel has a decided advantage with certain castings in obtainng ease of machining without sacrificing closeness of grain, in elimination of chilled sections of thin castings, and in further improving the quality of high-test irons.

Molybdenum is of value in lessening solid contraction in increasing transverse and tensile strengths, and deflection values on both the usual grades of iron and on high-test iron.

Chromium is a convenient medium for readily turning a gray iron into a white iron, thereby obtaining valuable properties such as wear resistance and resistance to growth. The technique involved in the manufacture of high-test and alloy cast irons will be improved as further knowledge of the subject is acquired.

Table VIII

Growth of Plain and Alloy Iron

	Mix No. 4	*Mix No. 1 plus 5 per cent Fe.-Cr.*		
Initial bar length, in.	11.8885	11.8000	11.8000	11.8000
10 Heats @ 1650 degs. Fahr., bar length, in.	12.1870	11.8350	11.8350	11.8600
15 Heats @ 1650 degs. Fahr., bar length, in.	12.3437	11.8550	11.8550	11.8600
Increase after 10 heats, in.	0.2985	0.0350	0.0350	0.0600
Increase after 15 heats, in.	0.4552	0.0550	0.0550	0.0600

Analysis (Mix No. 4) Per Cent		*Analysis (Mix No. 1 Plus) Per Cent*	
Silicon	2.34	Silicon	2.10
Sulphur	0.09	Sulphur	0.10
Manganese	0.63	Manganese	0.67
Phosphorus	0.38	Phosphorus	0.18
Total carbon	3.57	Total carbon	3.33
Combined carbon	0.42	Combined carbon	2.98
		Chromium	3.28

Refractories Institute Elects Officers

At a meeting of the American Refractories institute held June 3 in St. Louis, the following men were elected officers of the society: W. B. Coullie, general sales manager, Harbison-Walker Refractories Co., Pittsburgh, president; W. J. Westphalen, vice president and general manager, Laclede-Christy Clay Products Co., St. Louis, first vice president; A. P. Taylor, president, Chas. Taylor Sons Co., Cincinnati, second vice president; C. C. Edmunds, treasurer, McLain Fire Brick Co., Pittsburgh, treasurer; and Dorothy S. Texter, 2218 Oliver building, Pittsburgh, secretary. The following directors were elected: George A. Balz, president, Seaboard Refractories Co., Perth Amboy, N. J.; J. E. Lewis, president, Harbison-Walker Refractories Co., Pittsburgh; John R. Sproul, president, General Refractories Co., Philadelphia; A. P. Green, president, A. P. Green Fire Brick Co., Mexico, Mo.; J. D. Ramsey, president, North American Refractories Co., Cleveland; H. L. Tredennick, president, Haws Refractories Co., Johnstown, Pa.; J. H. Cavender, vice president and sales manager, North American Refractories Co., Cleveland; A. P. Taylor, president, Chas. Taylor Sons Co., Cincinnati, and S. M. Kier, vice president, General Refractories Co., Salina, Pa.

Prevents Losses

(*Concluded from Page* 43)

and reaching its widest field of employment in the stove plate and hollow ware branches of the casting industry. Wide above and thin below where it opens into the mold cavity, this type of gate is particularly well designed to catch a quick, wide dash of metal from the lip of the ladle. It allows the metal to enter the mold through a long, thin slit and the metal which remains in the gate after the mold is filled,readily may be removed by a sharp blow from a hammer. Properly and skilfully prepared this type of gate leaves practically no stump to be removed by chipping or grinding.

Whirl gates have been touched upon previously under the headings of *Dirt Catchers* and skimmer gates.

The term whistler is applied to a species of small riser and is based on the noise made by the rapid escape of air through a small orifice. In some instances the term is applied to any small riser, but in the majority of instances the term is confined to a small opening made by forcing a large vent wire through the sand immediately above a projecting part of the mold in the cope. Gas and steam show a tendency to collect in confined spaces, pockets, bosses, the top of thin wheel rims and other similar localities. The iron sets rapidly in these isolated places and may entrap some of the gas unless provision is made for rapid escape. The whistler or small riser at the highest point, supplies this exit.

This is the thirteenth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The fourteenth installment will appear in an early issue.

THE EDITORS.

Book Review

Gmelins Handbuch der Anorganischen Chemie, eighth edition, *Eisen*, Part B, Sections 2 and 3,200 and 144 pages respectively, paper, 7 x 10 inches, edited by the German Chemical Union, published by Verlag Chemie, G.m.b.H., Berlin, Germany, and supplied by THE FOUNDRY, Cleveland, for $8.50 and $6.50 respectively, postage 15 cents extra.

The two volumes mentioned are a continuation of a series on the chemistry of iron which form a part of Gmelins *Handbook of Inorganic Chemistry*, and which have been reviewed previously. Part 2 deals with iron and bromine, iron and iodine, iron and sulphur, iron and selenium, iron and tellurium, iron and boron, and iron and carbon. Part 3 relates to iron acetate, iron oxolate, iron tartrate, etc., iron cyanide, iron ferrocyanide, and iron ferricyanide. The main headings given hardly indicate the vast amount of information contained. In reality under the various headings abstracts are presented from the world's literature relating to the subject in hand.

Elliott Electric Co., 2178-86 West Twenty-fifth street, Cleveland and A. G. Acker, 1409 Keystone building, Pittsburgh, have been appointed local representatives for products of the Sprague division of the Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

A.S.T.M. Meets in Chicago

Attendance Largest in Society's History—Many New Tentative Specifications Proposed—Symposiums Were Feature

FEATURES of the annual meeting of the American Society for Testing Materials, held at the Stevens hotel, Chicago, from June 22 to 26, were the unusual attendance, the symposium on the effect of temperature on properties of metals held jointly by the society and the American Society for Mechanical Engineers, the symposium on malleable iron castings held jointly with the American Foundrymen's association, and a joint meeting with the Western Society of Engineers on the economic significance of specifications for materials to the producer, consumer, and purchaser. The attendance of approximately 1500, exceeded that of last year's meeting by nearly 50 per cent.

Data presented at the two symposiums will be of inestimable value to engineers, designers and foundrymen as that on the effect of temperature brings the knowledge of the subject up-to-date while the symposium on malleable cast iron brings together information on the material which hitherto has been scattered widely.

Activities of Society Expand

THE opening meeting of the A.S.T.M. was held Tuesday morning with President K. G. Mackenzie presiding. In presenting the report of committee E-6 on papers and publications, C. L. Warwick, chairman stated that one of the outstanding events of the meeting was the holding of three joint sessions with the American Society of Mechanical Engineers, American Foundrymen's association and the Western Society of Engineers. The topics covered in the sessions will be of vast importance to producers and consumers of engineering materials in that they deal with effect of temperature on metals, the properties of malleable cast iron, and the economic significance of specifications.

Mr. Warwick stated that the present meeting involved the publication of 112 of 132 items containing 1845 pages of technical material in the form of preprints. He also mentioned that a second revised edition of a special book of standards prepared for students in engineering would be ready for the spring term, and that a similar publication for students in chemical engineering and allied lines was in the process of preparation. In presenting the report of the executive committee, Mr. Warwick said that the committee recommended a change of by-laws to provide for sustaining members with dues of $100 a year. With the formation of district committees in New York and Cleveland in 1931, the society now has eight such organizations, and the Cleveland committee has requested a regional meeting be held in that city some time during March, 1932.

FRANK ORVILLE CLEMENTS, technical director of research laboratories, General Motors Corp., Detroit, and the new president of the American Society for Testing Materials, was born Nov. 9, 1873 at Westerville, O. He received his technical education at Otterbein college, Westerville, from which he was graduated in 1896. In 1899, he became assistant chemist for the Pennsylvania railroad. In 1905 he became chief chemist and engineer of tests for the National Cash Register Co., Dayton. He served as director of research for the Dayton Metal Products Co. from 1917 to 1920 when he entered the employ of General Motors Corp.

Reports of committees also included those on standards by T. R. Lawson; on nomenclature and definitions by R. E. Hess, and on methods of testing by W. H. Fulweiler. The session closed with the presentation of several papers. The first by Howard Scott, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., described testing technique for determining strength of metals at high temperatures by heating strip specimens constrained to different curvatures. G. S. von Heydekampf, Baldwin-Southwark Corp., Philadelphia, discussed damping capacity of materials as a measure of dynamic ductility, which should be coordinated with fatigue limit similar to the consideration of tensile strength and elongation. R. L. Templin and R. G. Sturm, Aluminum Co. of America, New Kensington, Pa., presented data on apparatus and technique developed for the determination of physical properties of special rubber compounds.

The sixth Edgar Marburg lecture was presented Wednesday by Dr. Ing. A. Nadai, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., on "The Phenomenon of Slip in Plastic Materials." The lecture was followed by the annual dinner meeting of the society which was held in the grand ballroom at 7 p.m.

H. F. Moore, University of Illinois, Urbana, Ill., and past president of the society, acted as toastmaster and introduced Col. Robert I. Randolph, president of the Chicago Association of Commerce who gave the address of welcome. K. G. Mackenzie, president of the American Society for

Testing Materials accepted in behalf of the society and then made his presidential address.

Mr. Mackenzie stated that while the society has made reasonable progress, its scope must be extended to enhance its present high standing, and to bring wider recognition from producers and consumers of engineering materials. Also the standing committees must be increased. Due to the wide distribution of membership, more regional meeting were suggested as a means to promote closer cooperation of the members, and to promote greater activity on specific problems local to the particular region. Mr. Mackenzie also stated that the society is faced with the necessity of holding semiannual meetings as it now has reached the point where it is becoming increasingly difficult to arrange sufficient sessions to cover the various fields. Mr. Mackenzie stressed the need for carrying on more research to advance knowledge of the various phases of engineering materials which goes hand in hand with the development of suitable specifications.

Dudley Medal Presented

After President Mackenzie's address the toastmaster called upon H. W. Gillett to introduce Dr. A. H. Pfund, John Hopkins university, Baltimore, recipient of the Dudley medal. Mr. Mackenzie presented the medal which is awarded by the society for the most outstanding, original contribution on scientific research. Dr. Pfund received the award in recognition of his work presented in a paper entitled "Hiding Power Measurements in Theory and in Application," given in 1930.

T. R. Larson, chairman of tellers appointed to count the ballots on the election of officers, reported the unanimous election of F. O. Clements, General Motors Corp., Detroit, as president; S. T. Wagner, Reading Co., Philadelphia, as vice president, and A. W. Carpenter, B. F. Goodrich Co., Akron, O.; J. D. Johnson, U. S. air corps, Wright field, Dayton, O.; G. D. C. Lenth, Clay Products association, Chicago; K. B. Cook, Manville Jenckes Co., Pawtucket, R. I., and O. L. Moore, Atlas Portland Cement Co., Chicago, as members of the executive committee.

A rather novel discussion was presented at a joint session of the society and the Western Society of Engineers held Thursday evening at 8 o'clock. The subject of the discussion was "The Economic Significance of Specifications for Materials" and was under the direction of Zay Jeffries, Aluminum Co. of America, Cleveland. F. D. Chase, Chase Co., Chicago, and president of the Western society, opened the meeting in which six papers dealing with specifications from the producer, user and purchaser viewpoints were presented.

John Brunner, Illinois Steel Co., Chicago, stated that between 5000 and 6000 specifications are in active use by his firm and that there are about 10,000 possible specifications in existence that apply to steel and steelworks materials. He also suggested that specifications should be written so that the steelmaker is given the choice of the most economical production methods for supplying the best product for a particular use. P. Parke, Pullman Co., Chicago, as a user said that specifications insure against waste and delay, uniformity of product from different sources, fair and unrestricted competition and insure the obtaining of the proper material for a given purpose.

Need Greater Research

J. P. H. Perry, Turner Construction Co., New York, and A. R. Lord, Lord & Holinger, Chicago, spoke on the use of specifications for concrete from the producer and consumer viewpoints respectively. Both urged closer cooperation between producer and consumer, and stressed the need for greater research in laboratory and field. The purchaser's side of the use of specifications was succintly described by J. W. Bancker, Western Electric Co., New York. Mr. Bancker stated that producer, consumer and purchaser benefited. For the producer specifications gave an open market, stabilized processes, reduced costs, and led to a better understanding with consumers. The consumer obtained wider sources of supply, better control of product, knowledge of the properties of materials, and a definite ground for acceptance and rejection. The purchaser is enabled to specify exactly the material desired which aids in receiving bids. Tradename restrictions are removed to a large extent, and correspondence between producer and purchaser on suitability, quality, etc., of materials are reduced. The meeting closed with a paper by H. C. Mougey, General Motors Co., Detroit, on purchase of motor oils.

Consider Temperature Effect

GENERAL interest in the subject of the effect of temperature on the properties of metals was indicated by the attendance at the symposium on that subject, held jointly with the American Society of Mechanical Engineers. The symposium was divided into two sessions which were held Tuesday afternoon and evening. Approximately 350 members and guests were present at each session, providing the largest gatherings in the annals of the society.

Summarize Papers

Twenty-eight papers were presented in preprint form for discussion at the sessions, and due to the large number of papers, brief summaries were given to prepare the way for discussion. The afternoon session was opened by W. L. Abbott, Commonwealth Edison Co., Chicago, and a past president of the A. S. M. E. who called attention to the fact that as soon as metals are developed to withstand higher pressures and temperatures, the power plant designer will find use for them. A. D. Bailey, Commonwealth Edison Co., Chicago, and H. W. Gillett, Battelle Memorial institute, Columbus, O. acted as chairmen, and L. W. Spring Crane Co., Chicago, presented a summary of the various papers for the session which dealt with engineering trends and requirements for metals at high and low temperatures. The papers covered power plant, oil, chemical, ferrous metal, nonferrous smelting and refining, automotive and aeronautical and the ceramic industries. Considerable discussion was presented in written form which in general was devoted to supplying additional information to that given in the various papers.

The evening session was held at 8 o'clock with F. M. Becket, Electro Metallurgical Sales Corp., New York, and H. W. Gillett, as chairmen. As in the case of the previous session 17 papers were presented in preprint form which were summarized by H. J. French, International Nickel Co., New York. The papers presented data on the properties of available metals for high and low temperature service, and included information on both ferrous and nonferrous materials. The discussion, as in the other session, was devoted mainly to presenting additional data to amplify and bring up-to-date, the material presented in the preprinted papers.

Discuss Corrosion and Fatigue

Corrosion and fatigue of metals occupied attention in a session held Thursday morning. The report of committee A-5 on corrosion of iron and steel presented by H. E. Smith, New York Central Lines, New York, mentioned additional failures in the seawater immersion tests. Results obtained by the committee indicate that the acid immersion test is inconsistent and does not forecast the relative life of ordinary ferrous materials in the

atmosphere. First failures of metallic coatings in tests also were noted. Gratifying progress in the investigation of steel embrittlement was reported.

J. A. Capp, General Electric Co., Schenectady, N. Y., chairman of the sectional committee on specifications for zinc coating of iron and steel, stated that the committee has developed a proposed tentative standard for hot-dipped galvanized hardware products. H . F. Moore, University of Illinois, Urbana, Ill., presented the report of the research committee on fatigue of metals which stated that summaries of present-day knowledge of corrosion fatigue, and of the significance of fatigue to designers and users of structures and machines, including a study of the conditions under which fatigue is not a significant factor, are being prepared. Continuation of the preparation of abstracts on fatigue of metals also was announced.

Oxygen Increases Corrosion

Increase in concentration of dissolved oxygen in city water in general produced an increase in corrosion rate, and the weight losses approached a constant value with time according to data presented in a paper by E. C. Groesbeck and L. J. Waldron, bureau of standards , Washington. Leopold Pessel, Philadelphia, stated that sprayed lead coatings gave the best results in an accelerated corrosion test in a sulphur dioxide-carbon dioxide-air atmosphere.

Fatigue tests on weld metal specimens 1-inch diameter show that the direction of deposition does not have a large effect on that value, and that rough, unmachined weld metal has a higher endurance limit than machined and polished weld metal according to results obtained by R. E. Peterson, and C. H. Jennings, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Peening increases the fatigue strength, and annealing at 1700 degrees Fahr. results in coarser grain structure and lower fatigue strength. Other papers presented at that session included "A 7-ton 50-cycle Fatigue Testing Machine," by B. P. Haigh and T. S. Robertson, Glasgow, Scotland, and "Endurance Testing of Steel: Comparison of Results Obtained with Rotating-beam versus Axially-loaded Specimens," by R. D. France, bureau of standards, Washington.

Cast iron and a symposium on malleable iron castings were the subjects discussed at a meeting held Friday afternoon, under the direction of J. A. Capp, General Electric Co., Schenectady, N. Y., chairman. President Mackenzie introduced N. K. B. Patch, president of the American Foundrymen's association who opened the session which was held jointly by the American Society for Testing Materials and the American Foundrymen's association. Hyman Bornstein, Deere & Co., Moline, Ill., chairman of committee A-3 on cast iron, presented a brief report of the committee's activities which included mention of the progress being made on an extensive investigation of impact testing, and the formation of new subcommittees on cast iron culvert pipe and automotive castings.

Test Cast Iron

The committee also recommended that the present revisions of the specification on high-test gray iron castings be advanced to standard. Mr. Bornstein presented a paper on a comparison of various sized test bars from five foundries, as an appendix to the report. Two other papers were included in the appendix and were by J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., on "Tests on Cast-iron Specimens of Various Diameters," and by H. H. Judson, Goulds Pumps Inc., Seneca Falls, N. Y., on "Shear Test for Cast Iron."

W. P. Putnam, Detroit Testing Laboratory, Detroit, presented the report of committee A-7 on malleable castings in which it was stated that a decision had been made to undertake a study of embrittlement of malleable cast iron in hot galvanizing. The committee has formed a new subcommittee to study the corrosion resisting properties of malleable cast iron. The proposed new tentative specification for high-strength malleable iron castings was withdrawn after discussion by members of committee A-7.

Following the reports of the various committees the symposium on malleable iron castings was opened by W. P. Putnam who briefly described the manufacture of those castings and the various physical properties. H. A. Schwartz, National Malleable Steel Castings Co., Cleveland, then presented some supplementary data and discussed the tensile properties. He was followed by Enrique Touceda, Malleable Iron Research institute, Albany, N. Y., who spoke on higher strength malleable iron, and the necessity for co-operation between engineer, designer and foundryman. In addition to the data presented in the symposium, O. W. Boston, University of Michigan, Ann Arbor, Mich., gave a short abstract of some results he obtained in investigating methods to determine machinability of malleable iron castings. F. L. Wolf and L. A. Meisse, both of the Ohio Brass Co., Mansfield, O., presented information on corrosion tests of malleable cast iron in a paper which was given in brief by Mr. Wolf.

Study Die Castings

UNDER the direction of F. O. Clements, General Motors Corp., Detroit, chairman, a session on nonferrous metals and metallography was held Friday morning. The report of committee B-2 on nonferrous metals and alloys presented by W. H. Bassett, American Brass Co., Waterbury, Conn., recommended for publication a proposed tentative method for the chemical analysis of silver solders, and stated that studies are being made of methods of chemical analysis of various standards and tentative standards already published. Mr. Bassett also presented the report of committee B-5 on cast and wrought copper and copper alloys.

C. H. Davis, American Brass Co., Waterbury, Conn., reporting for committee E-4 on metallography stated that a special committee has been appointed to obtain micrographs showing the spheroidization of high-speed steels, and that another committee is investigating the advisability of preparing grain size charts of standards for steel. Committee B-7 on cast and wrought light metals and alloys through J. B. Johnson, U. S. air corps. Wright field, Dayton, O., chairman, recommended the publication of tentative standards on aluminum alloy wire, rods and bars; on magnesium-base alloy sheets, and magnesium-base alloy wrought shapes other than sheets. It also was recommended that tentative specifications for duralumin sheet; for aluminum-manganese sheet; for aluminum base alloy sand castings, and for aluminum-base sand casting alloys in ingot form, be adopted as standards by the society.

H. A. Anderson, Western Electric Co., Chicago, chairman of committee B-6 on die cast metals and alloys, reported that the committee recommended the publication of two new tentative specifications on aluminum-base and zinc-base alloy die castings. T. S. Fuller, General Electric Co., Schenectady, N. Y., in presenting the report of committee B-3 on corrosion of nonferrous metals and alloys, mentioned the progress on and the extension of the atmospheric test program.

Fatigue and Die Casting

Four papers were presented during the session. Two dealt with fatigue tests of brass, one being by H. F. Moore and R. E. Lewis, University of Illinois, Urbana, Ill., and the other by J. B. Kommers, University of Wisconsin, Madison, Wis. The other two related to die castings. One of the papers was by D. L. Colwell, Stewart Die Casting Corp., Chicago, and was entitled "Effect of Composition on Aluminum-base Die-casting Alloys." The other was by F. J. Tobias, Newton Die Casting Corp., New Haven, Conn., and described lead-base and tin-base alloys for die castings.

Bridge Rail Panels Made from Malleable Cast Iron

Fig. 2—Erection of the Bridge Is Proceeding Rapidly

THE beginning of the art of bridge building probably lies in the efforts of primitive people who felled trees across the streams which came in their paths. Bridge construction from the engineering viewpoint may be traced to the Chinese, who were the first to employ the masonry arch for continuing roads across streams. During the fourth century B. C. the Romans, who inherited the engineering genius of some early tribes which inhabited the Mediterranean shores, attained their greatest development in bridge construction. Many of the bridges and aqueducts, built at that time and still standing, have formed the models for succeeding centuries.

While the masonry arch bridge was superior in beauty and durability, the tremendous demand for a more adaptable material due to increasing activity in railway construction in the nineteenth century, led to the adoption of metal bridge construction which practically eliminated the stone structures. The first use of metal for that purpose appears to be in a bridge constructed across the Severn by Abraham Darby. Cast iron ribs were used to form the arch. Later, bridge builders turned to wrought iron, as it afforded greater flexibility in construction and design, and the rapid development in production and quality of steel in turn led to its displacing wrought iron in the construction of bridges.

Two distinct phases may be observed in bridge construction, whether it be stone, cast iron, steel, or reinforced concrete, namely, utility and beauty. The first structures of the materials outlined were made strictly with the utilitarian purpose foremost. Little attention was given to appearance as long as the bridges met the engineering requirements. However, after sufficient skill and experience was gained, more and more attention was given to combining beauty with utility. As a

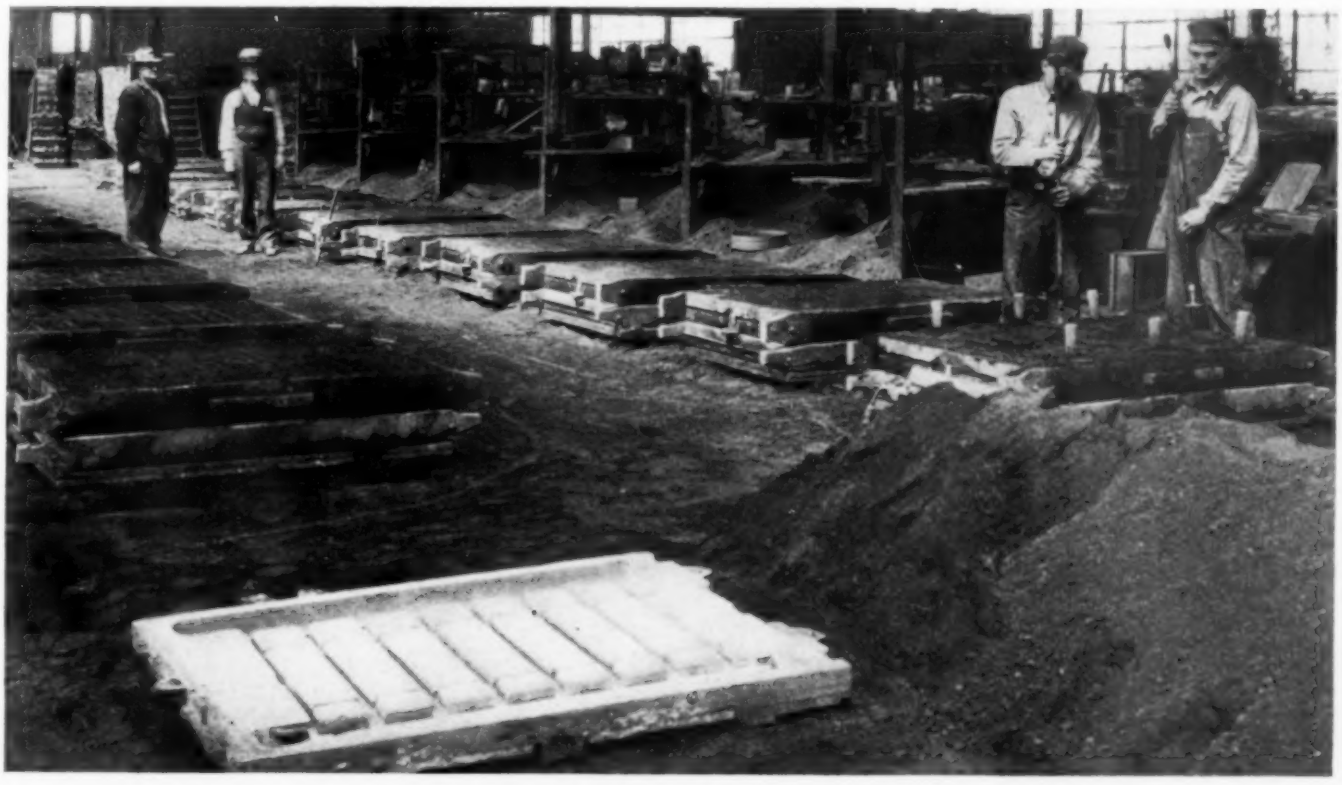


Fig. 1—A View of the Heavy Foundry Where The Bridge Panels Are Being Molded

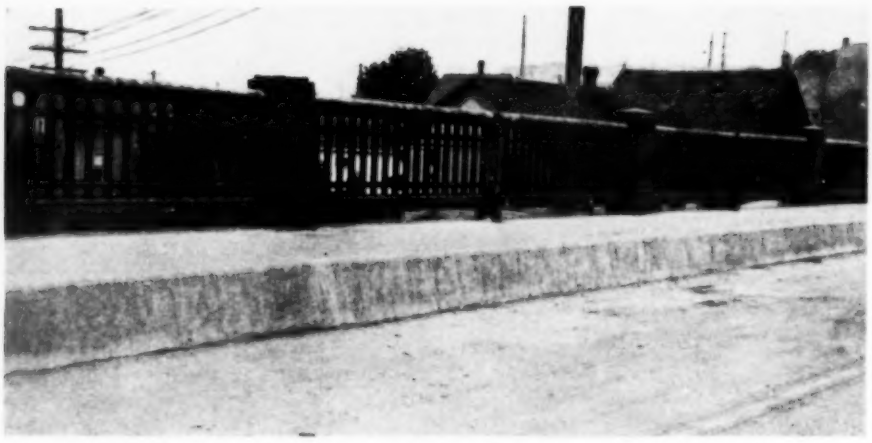


Fig. 3—Some of the Panels in Place on the Approaches

consequence many of the bridges, particularly the highway bridges, built during the past few years, display to excellent advantage the ingenuity of bridge designers to combine engineering skill and harmonious design in a bridge project.

In fact, to stimulate interest in the last mentioned features, the American Institute of Steel Construction, New York, for the past three years has appointed a jury of prominent engineers and architects to select the most beautiful bridge built of steel during the particular year. The competition is divided into three classes, namely, for bridges costing over $1,000,000; for bridges costing between $500,000 and $1,000,000; and for bridges costing up to $500,000 to erect. The three bridges selected as the most beautiful in their respective classes are decorated with bronze plaques by the institute, and the engineers, architects and builders are memorialized with special diplomas.

Cast Panels Are Used

One example of the modern trend in bridge construction is that depicted in the new bridge which now is being erected in Seattle across Lake Union and shown in Fig. 2. One of the interesting features of the bridge is the employment of malleable cast iron panels for the side rails of the bridge on both the approaches and the main span as indicated in Fig. 3. Over 1700 castings with a total weight of 210 tons will be used for the rails in the finished bridge. The rail panels are made in two sizes, one being approximately 30 x 56 inches and weighing 322 pounds and the other 30 x 45 inches and weighing 251 pounds. The heavy sections are used on the bridge approaches and the lighter ones on the main span. The average metal thickness of the castings is 7/16-inch. Test bars taken from each heat from which the castings are made must conform to the requirements of the American Society for Testing Materials specification A47-30 which calls for minimum values of 50,000 pounds per square inch tensile strength, 32,500 pounds per square inch yield point and an elongation of 10 per cent in 2 inches.

The rail panel castings are being made by the Moline Iron Works, Moline, Ill., which produces heavy and light malleable iron castings, brass and aluminum castings and patterns, automobile and saddlery hardware and molding machines. The firm maintains two malleable foundries or departments which specialize in heavy and light work respectively. Each department is equipped specially to handle its particular line of work.

The various plants maintained by the firm are designated by numbers. Plant No. 1 is located at Second street and Second avenue and is devoted to the machining, plating and finishing of castings and specialty items such as harness hardware, molding machines, automobile hardware and other cast products. One of the malleable foundries is plant No. 2, and it is adjacent to the one just described. The foundry proper is 90 x 420 feet with steel sash the full length of the building, and contains two 10-ton air furnaces. One end of the building is occupied by the core room and the pattern vault and pattern department.

Castings produced in the foundry are taken to the annealing and finishing departments which are housed in a building 110 x 350 feet. That building contains the tumbling mills for the hard iron castings, six annealing furnaces and four sand blast mills. The plant is engaged mainly in the production of the smaller types of malleable castings.

Plant No. 3 is located some distance away from the other two at Thirty-seventh street and Railroad avenue. That plant consists of three buildings which house the core room, foundry, and annealing and finishing departments. The core room 70 x 140 feet is adjacent to and midway of the length of the foundry, which is 110 x 400 feet. The foundry contains two 12-ton air furnaces. The annealing and finishing department is located in a building 40 x 110 feet which contains eight annealing ovens, and tumbling and sandblast mills. In the various plants, the layout is such that the materials move progressively forward without backtracking.

Finish the Castings

In addition to its foundries, the firm maintains departments for machining, plating with nickel, copper or cadmium, tin coating, hot galvanizing and japanning. Since the application of malleable cast iron to bridge rail castings is a comparatively new project, a description of the methods employed in their production will be of interest.

Iron for the castings is melted in 12-ton capacity, hand-fired furnaces as shown in Figs. 4 and 9. The furnaces are equipped with a secondary air blast which enters through 8 tuyeres in the roof of the furnace just behind the bridgewall of the firebox. Charges are composed of pig iron and return sprue with 0.5 per cent foreign scrap. Use of small furnaces, it is said gives a more accurate control of the iron composition, and enables the melter to puddle and skim the molten bath more thoroughly.

Due to the size of the bridge castings, special wooden flasks were con-

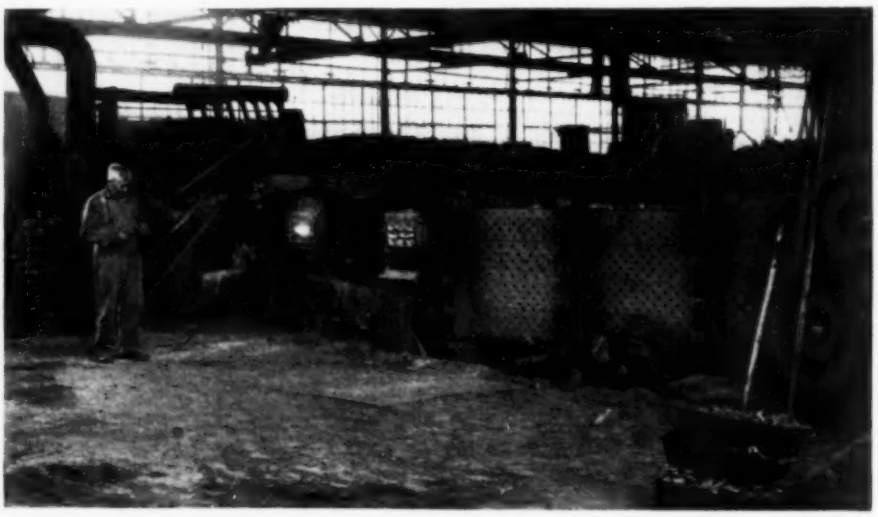


Fig. 4—Metal Is Melted in Furnaces of 12 Tons Capacity

structed. The flasks are about 36 x 72 inches and contain eight cross bars and one central bar which constitute a strong supporting grid effect. Patterns are made of aluminum as shown in Fig. 5 with hard sand matches, shown at the upper left in Fig. 5 and the left foreground in Fig. 1, for making the drag molds. The patterns, as may be observed in Fig. 5 are equipped with electric vibrators on each end for rapping. The vibrators are attached slightly to one side of the center line of the pattern to insure an even vibratory effect over the whole surface of the pattern.

Cores Form Grooves

The top and bottom of the castings are grooved to fit a 4-inch pipe which holds the panels in place on the bridge, and the grooves are formed with cores made in 20-inch lengths. Holes in the cores form the gate to the casting cavity and the attachment of the shrink bob. As shown in Fig. 5, three sprues and three shrink bobs are placed on each side of the casting cavity, and the mold is filled from six ladles poured three on a side into the respective sprues.

In making the molds the pattern is placed in the hard sand match with the drag face up. The flask is placed in the proper position by locating the pins of the flask in the guides on the match. Then 24 chills are placed in the diagonally opposite corners formed where the six vertical bars meet the two horizontal bars. Chills are not placed in the corners of the two end bars. After the chills are placed, a thin layer of facing sand containing seacoal is riddled over the face of the pattern. Then a layer of backing sand is shoveled in. The sand is tucked along the bars, peened along the sides of the flask, and rammed. More sand is shoveled in and peened and rammed, and the process is continued until the flask is filled. Excess sand is struck off with the handle of the combination rammer and peener, and a little loose sand scattered over the top of the mold. A bottom board is placed on the mold and clamped into position. Then the bottom board, flask and sand match are rolled over.

The clamps are removed and the hard sand match carefully lifted off and placed to one side. The pattern and the face of the drag are dusted with parting compound, and 24 chills placed in the diagonal corners of the bars as mentioned previously. Then the cope flask is located on the pins of the drag flask. The sprue plugs are set on the small prints on the pattern, and a layer of seacoal facing sand is riddled over the pattern and drag. Seventy-two gaggers are placed along the bars, and a layer of backing sand shoveled in. Peening and ramming of the sand is carried out as described until the flask is filled. The sprue plugs are rapped slightly and removed, and the sand at the mouths of the openings is pressed down so that there is no possibility of the sand being loosened when the molten metal is poured into the sprue.

Then the electric vibrators are set in motion, and the cope is lifted carefully. It is placed to one side on edge, and inspected thoroughly for defects in the impression. Occasionally patching is needed, but usually the cope lifts without any torn edges or stick downs, and that is attributed to the method of mounting the vibrators on the pattern, and the proper sand condition. Circular strainer cores are placed in the tapered sprue openings, and attention is turned to the drag.

The pattern is removed from the drag with the assistance of the vibrators, and placed to one side. The cores which form the grooves along the sides or top and bottom of the casting are placed in position. As the cores are 20 inches long, and must be placed in the print so that the sprue openings are up, it may be seen that two full cores and one half core are needed as the print left by the pattern is about 50 inches long. The two full length cores are placed at the two ends with the half core in the center. With the longer castings which are 57 inches long, three full length cores are used as the print is about 60 inches long. After the cores are placed in position, the cope is lowered into place and the two halves clamped together. Two men put up 18 molds per day.

Poured With Six Ladles

The molds are poured with six hand shanks, one to each sprue. After the castings have solidified, they are shaken out of the sand by the night gang, and appear as in Fig. 8. They are piled on trucks and taken to the cleaning room where the sprues, shrink bobs and fins are knocked off. Small projecting pieces of metal left from those operations are removed by grinding, and the castings then are sandblasted in a cabinet supplied by the W. W. Sly Mfg. Co., Cleveland.

Fig. 6.—Castings Are Stood on End in the Annealing Pots

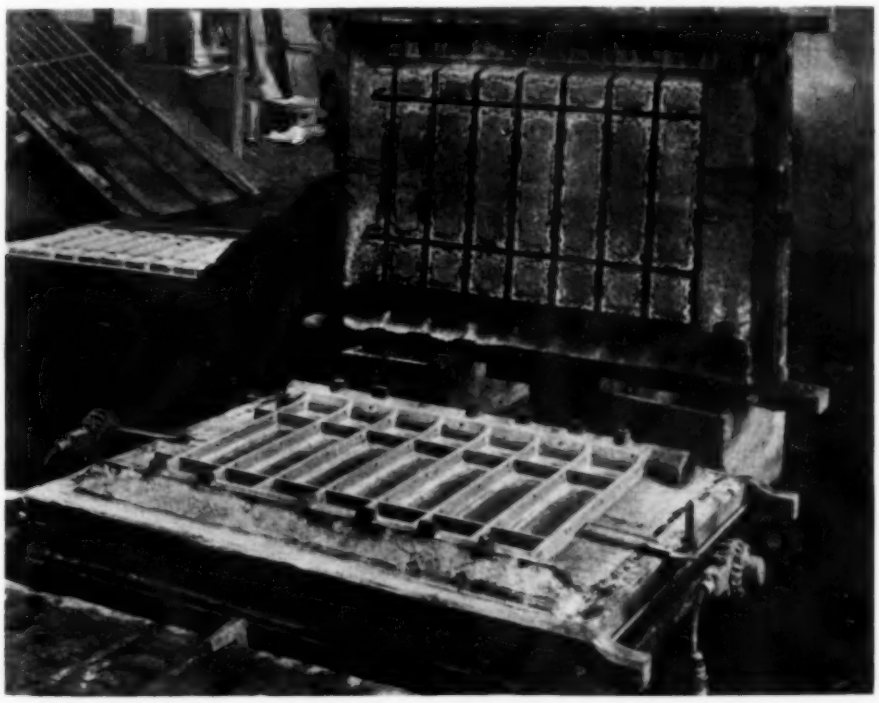


Fig. 5—Aluminum Patterns with Electric Vibrators Are Used to Make The Molds

Fig. 7—A Carload of Castings Ready for Shipment

Castings are annealed in rectangular pots built up of sections 10 x 24 x 36 inches. The castings are packed 6 to a pot and stand upright. Ordinary boiler cinders are used for the packing material. The ovens, shown in Fig. 6 are 14 feet wide and 20 feet deep and have an arched roof which is about 6 feet high at the lowest point. They are hand-fired with two fireboxes, and the port or flame openings are in the backwall just above the top of the pots.

Temperature conditions in the ovens are determined from thermocouples placed in several parts of the ovens, and connected to indicating instruments supplied by the Leeds & Northrup Co., Philadelphia. In the average annealing cycle for the rail panel castings, about 35 to 40 hours are required to bring the temperature up to 1700 to 1725 degrees Fahr. The castings are allowed to soak at that temperature for approximately 3½ days. Then the furnace is sealed and the temperature allowed to decrease slowly at the rate of 8 or 10 degrees per hour until a temperature of approximately 1300 degrees Fahr. is reached. Then oven is unsealed and allowed to cool rapidly, and then the doors are opened so that the pots can be cooled to a handling temperature. The latter usually occurs on the eighth day.

Two test specimens are placed in the bottom of each pot, and those are cast from the same heat as the castings placed in the pot. After being annealed the specimens are tested to meet the specifications outlined previously. The castings are dumped from the pots, and then transported to the cleaning room where they are sandblasted. After careful inspection, the castings are ready for shipment.

Book Review

Overhead Expense, by A. Hamilton Church; cloth 6 x 9 inches, 418 pages; published by the McGraw-Hill Book Co., Inc., New York, and supplied by THE FOUNDRY for $5.00 plus 15 cents postage and in London by the Penton Publishing Co., Ltd., 116-17 Caxton House, Westminster, for 25s, postage extra.

The author points out that overhead expense is increasing in importance as an item of industrial costs and that the older methods of lumping all charges, except direct material and labor, and applying the lumped cost as a percentage, is not

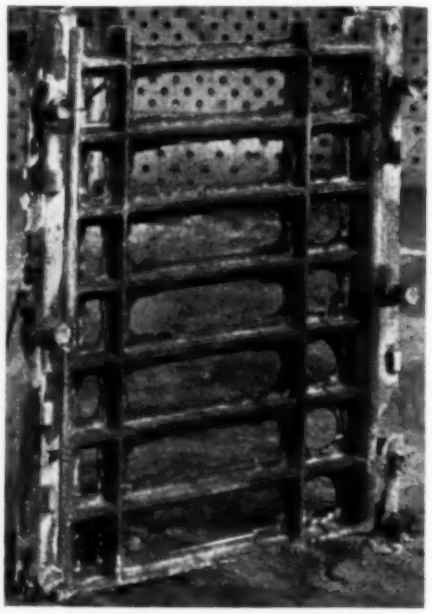


Fig. 8—The Casting After Shaking Out

in accordance with the best accounting practice. A further breaking down and close study of the separate items is advocated so that changes in conditions affect, not a vague total sum known as overhead, but separate and distinct factors in which the effect is confined to the class of change involved.

Cost accounting whys and wherefores are treated concisely and the ground is covered thoroughly as it relates to items of overhead expense. The work shows how overhead expense, whether of the plant as a whole or of a single process, can be costed precisely. It demonstrates how, once this is effected, the further determination of overhead expense, in whatever detail required, easily can be maintained. A general discussion of industrial cost accounting as related to overhead expense is followed by methods for the practical determination of service factors and process rates, the control of standardized overhead, and the relating of costs, sales, and profits. The subject matter is covered thoroughly and should be valuable to the manufacturing executive, accountant, or engineer.

Accident Frequency Rate Drops

The National Safety council, Chicago, recently published its 1931 edition of "Industrial Accident Statistics" covering injury records in 28 American industries for 1930 and some previous years. Material published on the foundry industry covers 138 plants whose employes worked over 103,000,000 hours during 1930. A summary shows that in the 138 plants during 1928, 1929 and 1930, the frequency rate of accidents decreased while the severity rate showed some increase. The data also shows that the frequency rate was the highest among the malleable iron foundries reporting and the lowest in the brass and aluminum foundries, and that the severity rate was the highest in steel foundries reporting and the lowest in brass and aluminum foundries.

H. W. Knight & Son, Seneca Falls, N. Y., maunfacturers of pattern letters and figures, has been incorporated under the name H. W. Knight & Son Inc. The business was established as a partnership in 1863. Officers of the new corporation are H. D. Knight, president; Robert W. Knight, vice president; and Dr. Robert Knight, secretary and treasurer.

Fig. 9—Inspecting the Hard Iron Castings for Defects

BILL

By Pat Dwyer

Finds Leaks Around Chaplets

BILL and I sat on the veranda Saturday afternoon and watched the rain falling on the street, pavement, and sidewalk with a force that sent the drops bouncing six inches. A veritable mill race ran down the gutter and poured into the catch basin at the street corner. Water dripped from the eaves, from the branches of trees, from the railing of the veranda and a regular stream gurgled down the water spout from the flat veranda roof. Sidewalks and street were deserted with the exception of a few swishing, slithery automobiles that dashed past like so many battleships throwing a bow wave to the curb on either side of the street. "God help all poor golfers on the greens a day like this," Bill said. "I know some lads who will insist on finishing their game so long as they can keep their heads above water." "Do you mean that heads above water in a literal or a figurative sense?" "Well," said Bill. "Since you raise the point—both! Any man who will allow pride and stubborness drive him around a dripping golf course, will allow the same motives to drive him around on other occasions when he should be attending to his own or the master's business. Sport is sport, and exercise is grand—for those who need it—but it becomes a vice, a disease, an obsession, a jolly strangling old man of the sea, when the alleged object of the game becomes more important than the game itself."

"You do not need to warn me," I pointed out graciously. "To sit here for a couple of hours in a rocking chair and watch the rain come down is about the height of my ambition. I have had my share of exercise—and then some. Others may have it all from this time forward."

"My dear lad," Bill said. "You are only an amateur. You have no idea of the amount of exercise connected with some jobs. I have a friend who is manager of a plant in the island of Madeira and believe me he does not need any person to rock him to sleep at night. He has installed equipment and machinery in some of the wildest and most inaccessible places—"

"Madeira?" I inquired. "Isn't that an island some where out in the Atlantic, owned by Spain or Portugal? I always thought that was a kind of a stopping place for steamers where the passengers ran ashore to stretch their legs and where the ship's stores were replenished with wine, bunches of raisins and sometimes a small pig."

Our Nell Suspects Them There Honeyed Words

"You are thinking of Robinson Crusoe," Bill said. "Modern steamers crossing the Atlantic stop no where for nothing. Our old friend Rob devotes several chapters to his adventures with the piratical gentlemen who operated off the northwest corner of Africa. He refers to them as Barbary pirates and Sali rovers. Quite possibly as a young lad you looked up Sali on the map and therefore you will have no difficulty now in drawing a mental line from that one time robber roost due west for a distance of 440 miles. Are you all set? Now draw another line southwest from Lisbon 600 miles. These lines cross at Madeira, the largest of a group of four islands, Madeira, Porto Santo, Deserta Grand and Bugio."

"All that is far away and long ago," I admitted. "I can remember Mr. Crusoe's reference to the Salee—that is how he spelled the word in my book—the Salee Rovers, but I do not recall any reference to Madeira. All I can remember is that every vessel he was on was lost shortly after he sailed. Invariably he clambered ashore and after a month"s heart breaking labor succeeded in launching a boat constructed from a few timbers that washed ashore. He stocked the boat with a small beaker of water, a few hanks of raisins and a young pig and then set out to be rescued. Finally he was stranded permanently, or almost permanently on one island, but that was a long way from Madeira and a still longer way from Bristol channel or any of the indentations in the long English coast line where all the jolly sailor boys ashore were dancing heel and toe." "Well," said Bill. "I'll tell you. There is something peculiar about the history of these Portugese islands with their neighbors the Azores and the Spanish Canaries. According to Herodotus, that chatty old grandfather of all historians, the Canaries were visited by the Phoenicians as early as 680 B. C., but there is no proper reference to Madeira until the 15th century. According to a legend, St. Brendon, abbot of Clonfert on the Shannon, lived in Madeira for 7 years. Details are lacking on why he left the ould dart for such an extended stay but he is reported to have described the island as an earthly paradise. The sun always is shining, fruit in infinite variety always is ripe and within reach, birds sing all the day long and no wild animals, snakes or noxious inserts disturb the heavenly tranquility. The venerable old gentleman died A. D. 578. Ten centuries later the island was discovered officially and the doubters and scoffers were put in their proper place.

"Probably in no other place in the world is the motorist confronted with such difficult conditions. In an afternoon's run from Funchal at sea level, one has to climb 2000 feet, then descend to sea level and then climb again 4000 feet, by zig-zag roads and around hairpin turns, a constant strain on the man at the wheel. If the ascent is made rapidly the head throbs unpleasantly until one becomes accustomed to the altitude.

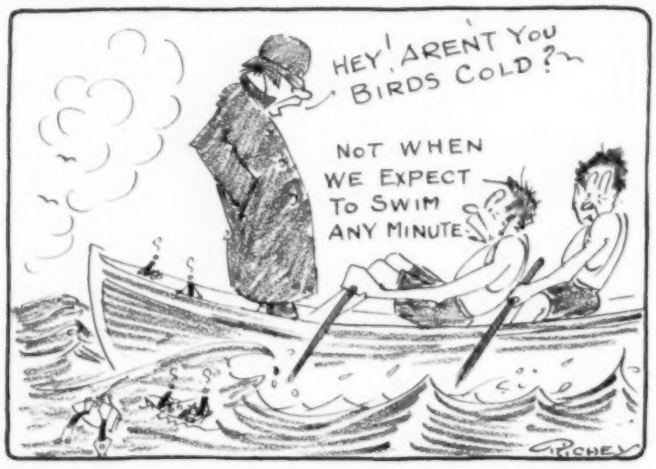
"Another method of travel is by hammock slung from a pole and carried by two or three bearers. After a short experience the amateur traveler usually prefers to walk. At the top of each hill, the hammock is reversed and as a result the passenger travels head first up hill and feet first down hill. At the stopping places along the hammock roads, hooks are provided in the tavern walls on which the hammock is suspended while the bearers refresh themselves at the traveler's

expense by tossing off a pot."

"Just a quaint old Spanish custom, eh?"

"Yes," said Bill. "It is a quaint old Spanish custom in the same sense that playing the bagpipes or wearing a shamrock is a quaint old English custom. Madeira is a Portugese colony.

"One of the first journeys this friend of mine made, lasted 2 hours during



A Cheery Word or Two Restores the Passenger's Confidence

the greater part of which he suffered from a racking headache induced by the thud, thud of the bearers feet transmitted through the pole. The road, in places, follows the edge of precipitous cliffs and the traveler's feelings were not improved by conjuring up visions of what would happen should one of the bearers slip. He allowed his Portugese assistant the privilege of riding in the hammock on the return journey. That able gent promptly fell asleep and slept through like a baby to the journey's end.

"In some instances it is possible to make a journey on horseback. The Portugese ponies do not keep to a regular step or speed, but amble, trot or gallop to suit themselves. They always gallop up a hill. After his first 4-hour round trip—his first horseback ride since a brief training period during the Boer war 25 years before—our hero ate from the mantlepiece for a week, found a constant succession of jobs out around the plant and shunned his office chair as if it was a viper.

"On one outlying job he had to travel part of the way by boat. The job lasted nine months and involved 60 round trips. One wet day he arrived all muffled up in gaiters and top coat and found four boatmen instead of the usual two, dressed in the skimpiest of garments, under shirts without neck or sleeves and a second garment somewhat resembling a pair of running shorts. While crossing the bay, shipping water at every dip, he asked one of the men if he was not cold. You can imagine the comfort he derived from the man's reply that he was cold, but that he could swim much more readily than in his usual garments.

"He then was regaled with tales of previous disasters and was shown the identical spot where so-and-so was drowned in just such weather as we are having now. All very snug and cheerful at a time when he felt sea sickness coming on and wanted to die.

"Ashore, the road climbed to an elevation of over 700 feet in 2 miles. He had to build the road with all necesary bridges and culverts. Every bit of material for the job, including the water for the concrete, had to be carried from the sea shore. After the road was built he brought a motor truck across from headquarters. The truck was loaded in four fishing boats, one wheel in each boat and the whole lashed together, man handled from the beach to the boats and then from the boats to the beach. It was such a novelty to the villagers that the younger members joyfully carried concrete blocks, cans of water, cement, etc., from the beach to the plant site for the privilege and pleasure of riding back in the empty truck.

"One night some of the lads broke into the garage—a hole in the rocks with corrugated sheets in front—and played cards in the illumination supplied by the head lights. The truck was not provided with a magneto and as a result was out of commission for a day while a messenger was bringing a new battery out from Funchal.

"On another occasion he built a cement plant on the neighboring island of Porto Santo, a 6-hour trip in a small coasting steamer. This is a nasty, boisterous journey on which 90 per cent of the passengers invariably are violently ill. The boat leaves at 1:00 a.m. and the only pleasant moment is when she docks. Then a relapse sets in and the passenger broods over the hardships of the return journey until the time comes to once more climb aboard. The trip is not recommended to excursionists.

"On this particular plant erected for a Swedish company, the chief was a Swede, the assistant a Dane, the engineer a German, my friend is English and the workmen were all Portugese. Each one of the group knew so little of each other's language that they compromised and found it easier to carry on any necessary conversation in Portugese.

"A stay is a delightful experience in one of these rural spots, in some ways centuries behind, where everything is simplicity itself. Money is almost unknown where nearly all trading is done by barter and exchange. The miller grinds the corn and mealies and takes a portion of the flour for his pay. Wine is produced under the same conditions.

"Absence of roads up to the present has kept the ubiquitous motor car out of these places, but a modern road building program now under consideration will soon open up and modernize these villages and rural districts. When the Angelus is rung from the small church steeples, every person within hearing stands with bared head, a quaint and touching sight.

"The people all over the island are extremely polite. This friend of mine was a bit disconcerted at first to have the men raise their caps in salute when he passed them and to be addressed as 'Your Excellency.' However, this quaint old custom is dying out. The rising generation almost without exception can read and write and rapidly are dropping the old deferential attitude. Many of the workmen are totally illiterate and their instructions have to be drawn in perspective on a blackboard.

"The *Festas* and saint's days cut down the productive time to a considerable extent. Christmas is not over until Jan. 6. Easter extends over a week and there are 7 or 8 days in June, besides odd days in the other months of the year. In recent years the tendency has been toward transferring the feast day to the nearest Sunday when the church is decorated with flowers and a band is in attendance. Many people play the local instruments, the bandolin. There is a good deal of dancing, a little drinking and a lot of fireworks and rockets. The pleasures of these people, like their other habits and customs are simple and innocent.

The Boys Will Have Their Little Game Before Retiring

"When this friend of mine first

took charge of the plant several years ago, the foundry department was in a bad way with the cost of castings almost prohibitive. Once a week on casting day, all hands were mustered to assist, at double pay and with a glass of wine thrown in for good measure.

"He selected the men needed on casting days, knocked out the double pay stunt and installed a piece rate system. The men promptly struck and remained out for three weeks. Then they went back and since that time have consistently earned more that the former day rate and are perfectly contented. Castings are made at a competitive price and in fact the importation of cooking pots almost has ceased. He still gives the men their 5 litres of wine on cast days.

"His coke comes from Germany, pig iron from England and most of the scrap is collected locally. A vessel loaded with scrap was wrecked off the coast about 5 years ago. The fishermen dive for the scrap in fine weather with a rope and hooks."

"A man must run up against a great many curious problems in a place of that kind, eh?"

"Well," said Bill, "I'll tell you. The foundry presents a continual problem nearly every place. I had a letter recently from a man who was having trouble with a machine tool base weighing 3200 pounds. The trouble was due to leakage around the chaplets between the main core and the oil pan core. A sketch which accompanied the letter showed a metal thickness in the walls and between the cores of ¾-inch except on the bottom where the thickness is 2 inches and 2½ inches in some places. The main cores cut through the bottom in some places, but they also are supported on chaplets and by the core prints at the sides. The pan core, 3 inches thick and in two pieces 30 x 36 inches, rests on chaplets which in turn rest upon the main core. The upper side of the pan core comes into direct contact with the face of the cope.

"The leaky areas are repaired by welding, but the process adds to the cost. He had tried discarding the chaplets and in their place had used sections of 3-inch diameter cores between the main core and the pan core. The method is quite satisfactory, but the machine shop objected to the expense of screwing plugs in the holes. Personally he thought it is six of one and half a dozen of the other whether the holes are plugged or the chaplets are welded. He would appreciate my opinion on this point or upon any practical method for producing a better casting.

"The proper method to adopt in molding this casting is to bolt the main cores down and suspend the pan cores from the cope. That will eliminate the use of chaplets. Certainly the method will entail a little more work on the part of the molder, but the casting will be perfect and the company will be relieved of further expense either for welding the leaky area in the vicinity of the chaplets, or in tapping, threading and screwing plugs into holes formed by sections of dry sand cores. It is possible that the present core prints on the bottom might serve the purpose, but if not, the pattern might be re-designed in a manner that will permit the use of bolts through the bottom core prints.

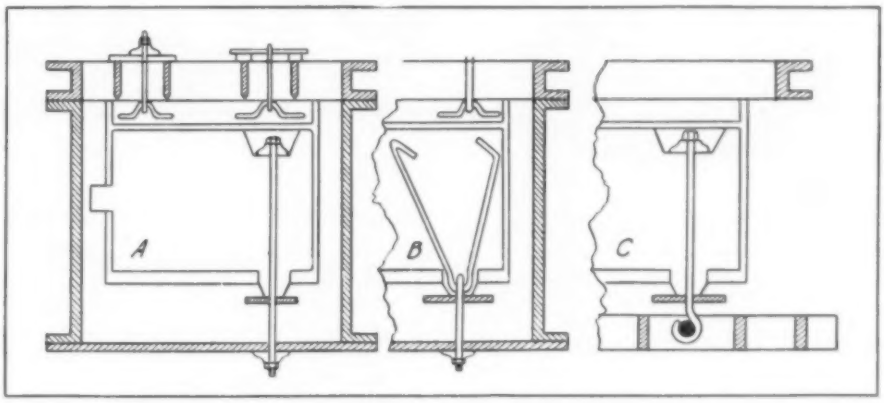
"Suspending the pan core presents no difficulty. A ¾-inch board is placed on top of the main cores and the pan core is placed in position. The cope then is lowered into place and a hook is dropped through each of the four holes in the cope to engage a loop in the core about 10 inches diagonally from the corner. The hook is provided with an eye or a threaded end where it projects above the cope and the eye is wedged up with a bar or the threaded end is tightened with a washer and nut. The cope with the core suspended then is lifted off and held temporarily while the molder is removing the piece of ¾-inch board from the top of the main cores. The combined cope and pan core then are returned to place.

"Two alternative methods are shown in the accompanying illustration for bolting down the core if the mold is made in a flask mounted on a bottom plate. A third method is shown for anchoring the core to a binder bar if the mold is made in a pit in the floor.

"In the first method shown at *A* a long bolt threaded at both ends is dropped through a suitable opening in the core after the core has been lowered into the mold. The upper end of the bolt with a nut and washer sinks into a recess in the top of the core provided for the purpose. The lower end also is provided with a nut and washer. Thus the bolt may be tightened from either end. After the bolt has been tightened the space above the upper end is filled with green sand to correspond with the remaining surface of the core.

"To make this sand stick, some molders smear the inside of the cavity with paste or thick oil. A little of either is not particularly harmful, but in the majority of instances of this kind no daubing of any kind is necessary. A few small nails driven into the walls of the dry sand cavity will anchor the body of green sand quite safely. An over dose of paste or oil will cause a boiling action in the metal and a dirty or porous area in the casting in that vicinity.

"In the method shown at *B* a large hook which may take any irregular shape is imbedded in the core in such a manner that the point of the loop appears in the core print which rests in the bottom face of the mold. A short hook, hooked at one end and threaded at the other end is attached to the loop in the core before the core is lowered into the mold. With the core finally in position, this short bolt extends a short distance below the bottom plate. A nut and washer are adjusted in place and tightened as in the first instance.



Several Alternative Methods Are Available for Suspending the Upper Core From the Cope and for Anchoring the Lower Core in the Bottom of the Mold

"Where the mold is made in a pit in the floor several devices are available for anchoring the core. In the method shown at *C* a hook bolt is anchored to a steel pin or bolt extending through both members of a double binder bar. The vertical bolt is adjusted in place and slides up through an opening in the core when the core is lowered into the mold.

"If the design of the pattern cannot be changed and he is forced to use either stool chaplets or thin sections of core between the main core and the pan core, the resulting cost of repair will be about the same. It is practically impossible to secure an oil tight union of metal around a chaplet placed in a ¾-inch plate as shown in the sketch. On account of the thick bottom, it is quite probable that the casting is gated at the bottom and as a result the metal has lost most of its *life* by the time it rises and flows into the thin plate separating the main and pan cores. By introducing hot metal from a second ladle through gates near the top and by using tinned chaplets he should secure an approximately oil proof pan. If one occasionally leaks, it is a comparatively simple job to drill it out and plug the hole.

Questions & Answers on FOUNDRY PRACTICE

GRAY IRON

Melting Point Varies

To settle an argument we would like to know which of the following materials takes the highest temperature to melt: Pure pig iron, common scrap iron, high silicon pig iron, low silicon pig iron, high carbon iron, low carbon iron, high manganese iron, and low manganese iron. The pieces of iron in mind are 4 inches square and 12 inches long.

The term melting point has no precise significance when applied to gray iron. If we accept as a definition that temperature at which the lowest melting point component becomes fluid, we would be forced to conclude that the initial meting point is around 1800 degrees Fahr., since the phosphorus-rich component, steadite, becomes fluid at that temperature. As a matter of fact the late Dr. Stead actually squeezed liquid phosphorus-rich material from a high phosphorus iron at somewhat above that temperature. If on the other hand we insist that the metal must be completely molten we find that it sometimes takes up to 3000 degrees Fahr. to dissolve heavy graphite particles in a short time.

As a general rule an iron is considered molten when it has passed above the liquidus of the iron-carbon diagram (subject of course to the influence of various elements and the effects of temperature lag). The lowest melting point on the pure iron-carbon series is the eutectic at 4.3 per cent carbon. In the iron-carbon-silicon series that eutectic is approximated by the formula, carbon plus 0.30 times the percentage of silicon. That is, an iron containing 3.50 per cent carbon and 2.00 per cent silicon is somewhat under but not far from it (3.50+0.60=4.10). An iron containing 3.40 per cent carbon and 3.00 per cent silicon is eutectic (3.40+0.90=4.30). An iron with 1.00 per cent silicon and 3.20 per cent carbon is decidedly hypereutectic (3.20+0.30=3.50), hence has a higher melting point than the other two mentioned. In everyday practice the presence of other elements lowers the eutectic percentages somewhat, and for most commercial irons, it will be found in the range from 4.10 to 4.20.

Other things being equal, a chilled iron will melt a little easier than a sand-cast iron. A high phosphorus iron will start dripping down before another iron similar in composition otherwise, but lower in phosphorus. Most pig irons are not far from eutectic composition because of their method of manufacture in the blast furnace, and the way they melt is determined more by their size, whether chill or sand-cast, the percentage of phosphorus, etc. rather than by whether they contain a high or low percentage of silicon. Obviously, a low silicon pig iron made low in silicon (which is unusual) will melt at a higher temperature than a high silicon, high carbon pig (which also is not so common) providing both are fully chilled, or fully gray.

Pig iron usually has a lower melting point than the iron made from it, hence the scrap from a heat would have a higher melting point than the original pig. However, in foundries making light and medium castings, the scrap is smaller in section than the pig, and because of the greater surface exposed to the heat, will tend to melt faster than the pig even though the melting point is higher.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

Q & A

Gives Silicon Range

What mixtures are used by automotive manufacturers for auto cylinders and heads? Does the iron machine freely, and is any trouble encountered from shrinks, segregations and cracks? We have a class of work that is heavy at one end and light at the other with sections running from ¼ to as high as 1½ inches. These castings are cylinder and bowl shaped, and we thought that iron used for automotive work might be satisfactory for them.

Some years ago many of the automotive cylinder blocks were made of iron which contained about 3.25 per cent total carbon, 2.0 per cent silicon, under 0.20 per cent phosphorus, 0.60 per cent manganese, and under 0.120 per cent sulphur. Such an iron would give about 30,000 pounds per square inch tensile strength, and show about 170 brinell hardness in the cylinder bore. Cylinder heads often were made of the same iron, and sometimes of a higher silicon, softer grade. The big problem was to obtain a hard, good wearing bore, and at the same time avoid chiled spots in other locations as well as to keep away from shrinkage spots.

If the silicon and carbon were lowered, chill spots were likely to occur, and if they were raised, the bore became too soft. Within the past several years, the use of irons with alloy additions has become common practice with many cylinder block manufacturers. Nickel allows the use of lower silicon and carbon, and gives a harder bore without machining troubles due to chill spots. The percentage of nickel may run from 0.50 to 1.25 per cent. With higher nickel percentages, about 0.25 per cent chromium is used. Some manufacturers are using molybdenum

as an alloy addition. The alloys mentioned increase strength and hardness when the mixtures are adjusted properly for the alloys added.

Iron used for automotive work is for sections that will range from 3/16-inch in the outside of the water jacket to about ½-inch in other places. Your metal thickness ranges from ¼ to 1½ inches, a greater range, and all in all, heavier section. If the general sections are about ¾-inch thick, you should obtain suitable results with an iron containing from 2.00 to 2.40 per cent silicon, total carbon from 3.10 to 3.40 per cent with about 0.50 per cent nickel to avoid chill on the thinner sections. Phosphorus should be kept low, and generous risers will aid in avoiding shrinkage pots.

Q & A

Melts Small Batch

What is the most economical method for melting a good grade of gray iron in batches as small as 800 *and* 1000 *pounds?*

Undoubtedly, the cupola is the most economical unit for melting gray iron as the iron comes into intimate contact with the hot fuel, and high melting ratios are obtained. For your purpose, a small experimental cupola will be satisfactory. The shell should be 27 or 28 inches in diameter, and the diameter inside the lining about 17 or 18 inches. Two tuyeres about 3 inches in diameter on opposite sides will give sufficient penetration of the blast. The charges of iron will weigh 100 pounds and the coke splits about 12 pounds. Such a small cupola will melt around 1000 pounds an hour.

However, if you desire to obtain the 800 or 1000 pounds of iron at one time, a considerably larger cupola will have to be used, say around 30 inches in diameter. Then all the iron could be charged at once and melted.

Q & A

Anneal Is Doubtful

We have a casting on our hands which our customer rejected as being practically impossible to machine. It is a flat slab 5 *inches x* 3½ *feet x* 7½ *feet. The only requirement is that the slabs be soft enough to drill, and we make them entirely from scrap. We were able to get some borings for analysis which showed the following: Silicon,* 1.80 *per cent; sulphur,* 0.675 *per cent; phosphorus,* 0.486 *per cent; manganese,* 0.71 *per cent, and total carbon by combustion,* 2.52 *per cent. We can see readily why the castings are so hard but are at a loss to account for the high sulphur and low carbon. Will it be possible to anneal the casting so that it will be machinable, and how can it be accomplished?*

We have doubts that the casting referred to can be annealed at a cost sufficiently low to pay for the results obtained. In the presence of 0.675 sulphur there is some question whether the casting will anneal properly at all. Our recommendation is to throw the casting away, and look into your coke and iron charges to see wherein the high sulphur and low carbon came from. Something is radically wrong.

GENERAL

Using Iron Bricks

Recently I saw a reference to the use of cast iron brick in the melting zone of the cupola. Have you any data on this practice?

Cast iron brick sometimes are used in the cupola, but not in the melting zone. They are used around the charging door, generally occupying the first 5 or 6 courses immediately below the door. Use of the brick is to prevent excessive wear at that point from the materials charged into the cupola. In the usual type of cupola, the upper portion seldom gets hot enough to melt the iron brick although it occasionally happens. They usually fail from being broken or by wear from the materials thrown against them.

The bricks are made in various shapes and can be made in the foundry where they are used. One form is that of a hollow shell with the back side open and a rib or bracket in the center. The walls are about ½-inch thick.

Q & A

Outlines Cupola Practice

We hear so many versions and figures on cupola efficiency we shall appreciate your opinion on the following points: 1—*What is the correct volume of air to a given amount of coke,* 2—*Does this factor vary where charges containing up to* 70 *per cent steel are used and where the iron must be exceptionally hot,* 3—*What percentage of the coke bed should be represented in the coke between charges of iron,* 4—*Would this percentage show a variation between ordinary gray iron charges and charges in which the steel content ran up to* 70 *per cent,* 5—*What is the best percentage of coke to melt a given iron tonnage,* 6—*What should cupola slag analyze under good melting practice?*

Taking your questions in the order of presentation, we submit the following brief comment: 1—Under good melting conditions 160 pounds of carbon and 425 pounds of oxygen are consumed in melting each ton of iron. The average grade of by-product coke contains 80 per cent carbon, therefore 200 pounds of coke will be required. Air at ordinary temperature, about 60 degrees Fahr., and at ordinary barometric pressure, 14.7 pounds per square inch, contains 23.1 per cent oxygen. A simple calculation will show that 1840 pounds of air are required to melt each ton of iron. Converted into cubic feet this means 24,000 cubic feet.

(2)—No. When steel is melted in the cupola it absorbs carbon and melts at approximately the same temperature as ordinary gray iron. (3)—The amount of coke on the bed depends on the height of the tuyeres, therefore no relationship exists between the amount of coke on the bed and the amount between the charges, (4)—Theoretically the same amount should be sufficient, but in actual practice it has been found that a slight increase in the amount of coke is required with large amounts of steel in the charge. (5)—Under exceptionally favorable conditions a ratio of 1 pound coke to 10 pounds of iron is maintained, but the average ratio is 1 to 8. Under good operating conditions, satisfactory cupola slag usually analyzes within the following range: Silica 35 to 45 per cent; alumina 5 to 26 per cent; iron oxide 5 to 8 per cent; manganese oxide 1 to 3 per cent; lime and magnesia 30 to 40 per cent. Higher silica usually is undesirable since it indicates a sticky slag, unless the iron oxide is too high.

Q & A

Weld Anvil Plates

Some time ago we read an article in THE FOUNDRY *describing how cast iron anvils are made. In one paragraph it stated:*

"Before the plates are placed in the mold they are sandblasted thoroughly and coated with oil. The least oxidation on the surface will prevent the molten metal from adhering." Can you give us any further information on this point?

There is practically nothing that can be added to that statement. The plates must be perfectly clean and the coating of oil is applied principally because the plates are prepared in quantity and must be preserved from surface oxidation until they are used. This is only one of the features necessary to the production of the castings. The manner in which the mold is filled with iron is just as important.

An empty space in the mold under the plate is first filled with molten iron. This iron raises the plate to a bright red heat before the iron is poured into the mold proper and thus facilitates the union of the molten iron with the plate. In some instances it is necessary to provide a flowoff immediately above the level of the plate. A certain amount of iron is flowed over the plate. The amount depends on the temperature of the metal and the thickness of the plate. When the pourer decides that the upper surface of the plate has been raised to the welding temperature, the flowoff is plugged and the remainder of the iron in the ladle is poured into the mold. It is rather a tricky process and a great deal depends on the skill and judgment of the molder. Needless to say the iron must be poured at an exceedingly high temperature.

Problems in Nonferrous Founding

By Charles Vickers

Suggest Chill Mold

We are making aluminum bars 16 inches diameter by 18 inches long. The castings are of solid metal and we gate them at the bottom with the top closed and put on top a head 8 inches high and the full diameter of the pattern. We use No. 12 aluminum with 2 per cent silicon added. We pour at 1125 degrees Fahr. The castings come with fissures on the sides and contain holes about 1-inch deep in the circumference of the casting.

The difficulty is a common one when casting solid rolls of aluminum alloy. One reason is that there is a tendency to pour massive castings too cool. For while trouble may be encountered when pouring too hot, it is also possible to go to the other extreme. As the melting point of the No. 12 alloy is 1175 degrees Fahr., and the pouring temperature of that casting is given at 1125 degrees Fahr., it looks as though your pyrometer is not registering the temperature correctly. It will be necessary to have it checked if you expect to obtain any results.

We suggest a pouring temperature of not under 1200 degrees Fahr., Also bear in mind that aluminum is only one-third the specific gravity of brass. It is usual when pouring brass bars 6 inches diameter to put a 14-inch high head on them. Therefore give the mold more head and pour hotter. The surest way of making such castings in aluminum alloy would be to use a chill mold.

Q & A

Determines Arsenic

The railway firm that I am associated with purchases copper rod for stay-bolts, etc. with an arsenic content from 0.3 to 0.5 per cent. What is the simplest method for determining that content? The laboratory is small so that a distillation method is not desirable.

The following modification of Pearce's original method may be used especially where distilling apparatus is not at hand. Weigh 0.5 to 5 grams of the sample into a nickel crucible and mix with 5 to 10 grams of a flux consisting of 2 parts sodium carbonate and 1 part sodium peroxide. Fuse at a low temperature until the charge is completely liquid. Cool until the melt just solidifies, and plunge into cold water contained in a 400 cubic centimeter capacity beaker. Cover, and when violent action ceases, warm for 30 minutes on the steam plate. Remove the crucible, and filter, washing 4 times with hot water. Acidify the filtrate with acetic acid, heat and boil until the carbon dioxide has been expelled. Allow to cool, add phenolphthalein and then sodium hydroxide solution until a red color appears. Again cool, and add acetic acid until the red color is just discharged.

Take a sample of from 5 to 500 cubic centimeters, depending upon the amount of arsenic present. Dilute to between 300 and 500 cubic centimeters, add 10 cubic centimeters of hydrochloric acid, and pass in hydrogen sulphide for 30 minutes. Filter off the sulphides, and dissolve through the filter paper with warm, dilute ammonia. Add an excess of nitric acid, heat to boiling, cool and make alkaline with solid sodium peroxide. Cool and neutralize as previously described.

To the clear solution from either of the solutions mentioned in the two preceding paragraphs, add silver nitrate solution in excess. Dilute to 500 cubic centimeters volume to dissolve any silver acetate that may form. Allow to settle, and wash the red silver arsenate 4 or 5 times by decantation; decanting through a filter paper. Then wash the precipitate on the paper, and wash until the wash water shows no test for silver nitrate when tested with hydrochloric acid. Dissolve the precipitate through the filter paper with warm nitric acid (1 to 1 solution) into a clean beaker. Add a solution of ferric alum as an indicator and titrate with standard ammonium thiocyanate solution until a permanent red color forms. Calculate to arsenic trioxide or arsenic as desired.

For the standard ammonium thiocyanate solution dissolve 4.68 grams of the salt (NH_4CNS) in water, and dilute to 2 liters. Standardize against pure silver nitrate and calculate to arsenic trioxide. The silver standard multiplied by 0.2316 is equivalent to the arsenic standard; 1 cubic centimeter of the ammonium thiocyanate solution is equivalent to 0.001 grams of arsenic trioxide. For the ferric alum solution dissolve 40 grams of the salt in 1 liter of distilled water and allow to stand.

Described in Literature

Has there been any book published on the subject of molding and casting bronze tablets, statuary and other forms of ornamental castings? We shall be glad to order a copy if such a book is available.

So far as we know, and this knowledge only extends to books published in the English language, no book has been published dealing exclusively with the subject of molding and casting ornamental brass and bronze castings. Brief reference to the subject has been made in several books dealing with general foundry practice, but these descriptions are designed more to convey to the average foundryman a general idea of the process, than as instructions that would be of any use in actually attempting the work. Also these books now are out of print. Formulas for the metal mixtures are contained in *Practical Alloying*, by Buchanan; *Metals and Their Aloys*, by Vickers and in the *Foundrymen's Handbook*.

Practical description of the methods and equipment employed in this branch of the foundry industry have appeared in The Foundry on many occasions. Among others in a long list you might consult the issues of May 15, 1923, July 1, 1924, April 1 and June 1, 1927; Oct. 1 and Oct. 15, 1928; Sept 15, 1929 and Feb. 1, 1930. Three of these articles cover the subject of making tablets. The others deal with the practice pursued in the production of statuary in various foundries which specialize in this section of the foundry field.

Q & A

Alloy Is Stronger

We desire information on aluminum bronze. What different combinations are used, and what are their tensile strengths, hardness, and abrasion resistances? We want an alloy that will give a somewhat increased strength over aluminum with better wearing qualities. Also an alloy that will cast with reasonable ease.

Aluminum bronze is not the type of alloy on which information is desired, as the sentence "somewhat increased strength over aluminum" indicates that information on aluminum alloys is desired. Aluminum bronze is at the copper end of the scale while alumi-

(*Concluded on Page* 65)

The FOUNDRY Family Photograph Album

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Upper Right

J. J. WALSCH

Clark Equipment Co., Buchanan, Mich.

Lower Left

E. W. ROBERTS

Roberts Brass Mfg. Co., Detroit

Lower Right

C. J. FREUND

Falk Corp., Milwaukee

TENTATIVE RECOMMENDED PRACTICE FOR

Copper 85, Tin 5, Lead 5, Zinc 5 Alloy

Development and Field of Use

This alloy formerly was knows as ounce metal, owing to the ratio of copper to any one of the other three elements being approximately 16 to 1. It has many variations in its composition, due to the fact that it is a widely used alloy. It is generally recognized as a high-grade nonferrous alloy, giving satisfaction in the manufacture of many pressure castings, certain bearings and for all work where good color and ease in machining are important factors.

Chemical Control

The chemical composition should be known and controlled at all times, as variations may be the cause of unsatisfactory results in the castings. By varying the tin, lead, zinc and phosphorus, it is possible to change the alloy's melting point, freezing range, shrinkage, pouring temperature, fluidity and other physical properties.

Physical Properties for Sand Casting

Ultimate tensile strength (minimum to average practice) lbs. per sq. in.	26,000-32,000
Proportional limit in tension (approximately) lbs. per sq. in.	8,000-10,000
Yield point in tension (minimum to average practice) lbs. per sq. in.	12,000-15,000
Elongation in tension (in 2 in.) usual range, per cent	15-25
Compression of 0.001 in. (on cylinder $\frac{1}{2}$ in. square cross-section and 1 in. high)—lbs., approx.	10,000-12,000
Compression of 0.1 in. (on cylinder $\frac{1}{2}$ in. square cross section and 1 in. high)—lbs. approx.	32,000
Brinell hardness number	48-58
Pattern maker's shrinkage—inches per foot	3/16
Specific gravity	8.7
Weight per cubic inch—pounds	0.314
Resistance to impact (Izod test), ft. lbs., approx.	8

Sand

Sand of about A. F. A. No. 1 or No. 2 grain size, D to F clay content or grain fineness about 140, and clay content 5 to 20 per cent, is suggested for this alloy, as most castings made of it must be smooth and clean. The sand must have such bond that it will not scab but will lift well. It should be such that lettering and other detail will be sharp. Sometimes it may be advisable to spray the mold with molasses water and dry to obtain the best results.

Abstracted from a report of the nonferrous committee on recommended practices of the American Foundrymen's association.

(*Continued on Data Sheet No.* 870)

TENTATIVE RECOMMENDED PRACTICE FOR

Copper 85, Tin 5, Lead 5, Zinc 5 Alloy

(*Continued from Data Sheet No.* 869)

Cores

Fine silica sand and a good grade of core oil are suggested for this alloy. Painting the core with graphite may help in making castings smoother on the inside. Additions of sandblast dust or silica flour to the core-sand mix often will increase its ability to stand while green and to make a much stronger dry core.

It is important to have strong, well-vented cores, as many of the castings are intricate, have thin walls and much pressure is placed on the core when the metal is being poured. However, the cores must not be hard enough to cause castings cracks or difficulty in shaking out.

Gating and Heading

Gating and heading of castings made of the alloy is important. A study of each particular class of castings should be made before deciding what type of gate is to be used.

(a) Castings such as heavy-flanged valve bodies must have feed heads for the flanges, and a skimmer gate with a blind head is suggested.

(b) For castings such as index plates and light uniform castings, where speed of pouring is necessary to run them, a choke gate is used.

(c) For castings of nonuniform section where speed of pouring is necessary to run them, the use of choke gates and feeding heads, set on the heavy parts to take care of the shrinkage, is suggested.

(d) Castings of the small uniform variety may best be gated by a simple brass or bronze gate.

Cleaning Castings

Gates and heads on castings made of this alloy are removed by various methods such as the band saw, sprue cutter, friction wheel, or breaking off while hot. They are cleaned by blasting. If rumbled, they are easy to mar.

Chilling

Simple castings can be made in chills successfully and have a dense grain. However, many of the castings made of the alloy are intricate and not well adapted to this process.

Melting

General good furnace practice is necessary for this alloy. A pouring range between 1950 and 2300 degrees Fahr., according to the thickness of the castings,

(*Concluded on Data Sheet No.* 871)

The Foundry Data Sheet, July 15, 1931

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

(*Concluded from Page* 62)

num alloys are at the aluminum end. There is little comparison between them for aluminum bronzes are the strongest alloys. Some of them in the sand-cast condition will reach tensile strengths around 100,000 pounds per square inch with good elongation. The specific gravity of aluminum bronze is about 7.5 or over 2½ times that of most aluminum alloys.

Aluminum of 99.40 per cent purity will possess a tensile strength around 13,000 pounds per square inch, an elongation around 29 per cent, and a reduction of area around 50 per cent. However, it is too soft for most purposes. When it is alloyed with 8 per cent copper, the elongation decreases considerably. Usually it ranges from 1 to 2.5 per cent while the tensile strength increases to 18,000 to 23,000 pounds per square inch. Its specific gravity wil be about 2.85. The 8 per cent copper-92 per cent aluminum alloy is known as No. 12 alloy.

In recent years the No. 12 alloy has not been used to its former extent. Many new alloys have been developed, and those may be purchased in ingot form from the producers with information on handling the alloys. One of the alloys contains 85.75 per cent aluminum; 10.5 per cent zinc; 2.50 per cent copper, and 1.25 per cent iron. In the as-cast condition, its average tensile strength will be about 30,000 pounds per square inch with an elongation of 4.2 per cent. The alloy may be heat treated.

Q & A

Litharge Is Oxidizer

Will you explain why the oxidizing flame is preferable to the reducing flame in melting nonferrous alloys? Also what is the action of the litharge?

A reducing flame is one containing an excess of carbon indicating that a portion of the fuel is unburnt. This excess fuel may be in the form of a smoky flame or as carbon monoxide. The gas aerates the brass and produces for one thing porous castings and pitted castings. To avoid such troubles it is the part of wisdom to have the furnace atmosphere slightly oxidizing, that is containing more than sufficient air to burn all the fuel, so there will be no excess of the latter. In the case of open flame furnaces where a large surface of metal is exposed to the action of the flame the metal must always be covered by a thin film of slag, produced by the melting of some flux, such as glass. This flux saves the metal from the punishment of the flame, but as the heat has to pass through the slag to reach the metal, this covering has to be thin. If it gets thick through accumulations of debris from the furnace walls, is must be skimmed off occasionally. Under the above conditions the metal is protected against oxidation by the flux, and such melting has been found by experience to give the best results in the castings.

While we should burn all the fuel gases and waste none, it is harmful to have a large excess of oxygen. So we have to strike a happy medium. It is rarely possible to maintain a neutral atmosphere, as conditions are sure to change from time to time. To be on the safe side, the neutral atmosphere has to be overstepped a little on the oxidizing side. However, when a mistake has been made and too much reducing flame used, the role of litharge is to correct this by acting as an oxidizer. If trouble is experienced from porous castings, and everything tried is ineffective; phosphorus either does no good, or makes it worse, the chances are in favor, that the wrong measures are being taken. Instead the metal is over-deoxidized before the phosphorus is added. Try the effect of a little litharge, scattered on the surface of the molten metal and gently rabble it in.

Reader's Comment

Editor's Note—***Material Appearing Under This Head Does Not Necessarily Reflect the Opinion of The Foundry or of Its Editors.***

The Going Is Hard

To The Editors:

I have just read the article by C. J. Freund on foundry apprenticeship in the June 1 issue of The Foundry.

It appealed to me, not because I am a foundry executive interested in instituting an apprenticeship course in my foundry, but because I have, like Leslie Parker, found no way of furthering my training in the occupation that I have chosen to follow.

The article spoke of the task foundries have in attracting young men with educational training. It also expressed an understanding of the small chance a young man has of securing employment in a foundry where he has the opportunity of learning. I am taking this advantage of seeking advice and beneficial information on the subject.

My father has owned and operated a gray iron foundry for the past 25 years. I have been in close contact with foundry work all my life. I worked in my father's foundry and other foundries during summer vacations. Anyone would be very self-assured to say that they possessed the qualities of character described in Leslie Parker, but like him, I have found the foundry to be interesting and have chosen to follow it.

I went through high school and college taking such courses that I thought would benefit me in the foundry. I finished with a B. S. degree in mechanical engineering in 1929.

I then decided to get into the steel end of the foundry industry and secured employment in the steel foundry. I have been with them nearly 14 months. My relations there have been the very best, but due to the lack of work and also the lack of system that would enable them to shift a man through the various departments, I have not completed the training that I wish to get in the steel foundry.

When I went to work I had an understanding with the management that I did not want a job only as a molder's helper but wanted a training in the various phases and departments of the plant. However, due to the lack of an exact outlined apprenticeship system that the article outlined, and the continuous dropping off of work it was impossible to shift me around in the different departments. With the exception of a month helping the pattern checker and three days in the core room I worked the rest of the time as a molder's helper on the large steel casting floor.

I would like very much to get with some steel foundry that has an outlined apprenticeship course as Mr. Freund described. If you could give me any helpful information it would be appreciated greatly.

A Reader.

Formula Presents Puzzle

To The Editors:

While The Foundry always is interesting, I have been particularly interested in Pat Dwyer's present series of articles on gates and risers. However, I am puzzled by a formula which appeared near the bottom of the third column, page 85, in the May 15 issue. This formula reads:

$$\text{Area of choke} \frac{0.32 \sqrt{100}}{15.7} = 0.81 \text{ sq. in.}$$

Manifestly this is impossible and I shall appreciate Mr. Dwyer's explanation.

W. L. Rinehart.

Curtis Mfg. Co.
St. Louis, Mo.

Editor's Note—Through one of those unfortunate errors that occasionally appear on the printed page despite the most lynx-eyed scrutiny on the part of all through whose hands it passes in course of preparation, the symbol indicating the extraction of the square root was omitted from the lower line of the formula in question. In the original and correct form it appears as:

$$\frac{0.32 \sqrt{100}}{\sqrt{15.7}} = 0.81.$$

We greatly regret the error and trust that this explanation will meet the eye of any other readers who may have shared Mr. Rinehart's bewilderment.

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ An Industry Moves Forward

FEW trade associations in any industrial field have surpassed the Gray Iron institute in progress recorded during the first three years of endeavor. The ever expanding work of the institute during that short period has achieved a position of leadership within the gray iron industry, and has won recognition and praise from associated groups and governmental bureaus. Today, the institute provides the vehicle by which the industry can eliminate unprofitable practices in manufacturing and merchandising gray iron castings. Through its efforts, designers, engineers and the public in general are securing a clear conception of the valuable properties to be found in the product manufactured by the members of the group as well as the industry as a whole.

THE Gray Iron institute was organized at an enthusiastic meeting held in Philadelphia in May, 1928, during the annual convention of the American Foundrymen's association. The impetus culminating in the founding of the group developed earlier in the year when groups in the east and the central west recognized the need for such a trade organization, and, substituting complete co-operation for all selfish interest, combined efforts to avoid duplication and confusion.

THE purpose of the institute from the start has been the promotion of the interests of the gray iron industry. The founders of the organization believe that the purpose can be accomplished best through promotion of sound business ethics in the industry; collection and distribution of information on the manufacture of gray iron castings; development of new methods of merchandising; promotion of uniformity in methods of cost accounting; co-operation with members and other research agencies to further the quality of gray iron castings; stimulation by co-operative effort of the use of gray iron castings; and establishment and maintenance of standards of quality for gray iron castings. A glance over the record of the past three years shows how well the officers of the institute have worked to realize the major purposes of the organization.

A STANDARD cost system, recognized as an exceptional piece of work by experts in the field of manufacturing costs, has been developed by the institute and offered gratis to the entire gray iron industry. Members may secure the services of cost experts through the institute to install and perfect the operation of the system. Merchandising problems have been studied, and valuable information on gray iron castings has been prepared and distributed through the institute. Studies now are under way to determine the costs of adding various percentages of alloys to gray iron castings.

RECENTLY the standard sales agreement and trade customs, prepared by the institute, has been approved by the National Association of Purchasing Agents. The research department of the institute now is working on a classification of gray iron castings. These are only a few of the important and valuable contributions which the Gray Iron institute has made to the foundry industry during the past three years.

The work already accomplished has been great, and the future possibilities for service to the industry is so far reaching that THE FOUNDRY has dedicated the front cover of this issue to further the work of the Gray Iron institute.

¶ Research Promotes Progress

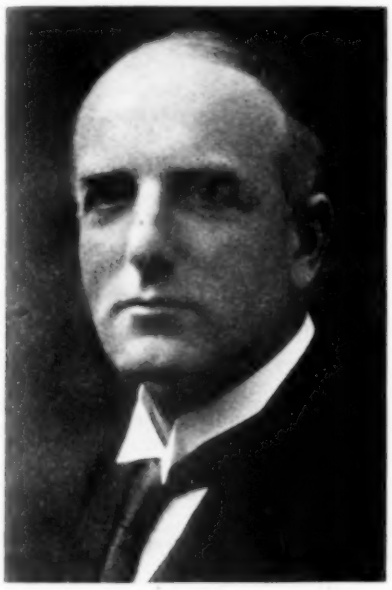
FRANKLIN was the first great American scientist. He was the inspiration and guide for all electrical engineers, according to a recent statement by Dr. Willis R. Whitney, vice president and director, research laboratory, General Electric Co., Schenectady, N. Y. That statement is a great compliment to the electrical industry for it shows that it has grown to its present huge proportions in a relatively short period when compared with the castings art which has been in existence for centuries. Both industries occupy enviable positions in the industrial structure of the nation, but one has achieved its place in a much shorter time than the other. Why? The secret lies in one word, research.

RESEARCH, the application of pure science to the solution of industrial problems, the diligent searching for new principles, is known only to a limited degree in the foundry industry. Many discussions on foundry problems have been presented and ingenuous theories have been advanced which satisfy those who champion them, but fundamental research has not been available to say which are correct. If the foundry industry is to continue to advance the solution of common problems of the industry should be undertaken without further delay.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

A HARLEY, for more than 20 years foundry manager, Daimler Co., Coventry, England, recently was elected president of the Institute of British Foundrymen. Mr. Harley is a native of Falkirk, Scotland, and received his education at Falkirk high school and Glasgow Technical college, Glasgow. He was trained as a metallurgical chemist in the laboratories of the Carron Co., Carron, Sterlingshire. Later he was associated with the Alloa Coal Co., Alloa, Clackmannanshire, for about



A. Harley

two years where he was in charge of the surface plant at the new collieries then being developed near Bannockburn. He next was connected with the Coalbrookdale Co., Shropshire, as assistant to the general manager. After a nine-year association with that company, he resigned to supervise the erection of a new foundry for the Daimler Co. He was made manager by that company and has held that position for the past 20 years. In addition to his duties as manager, Mr. Harley has been in charge of the general laboratories of the company and the heat treating department for the past nine years. He has been a member of the Institute of British Foundrymen for 20 years and is a past branch president.

Thomas H. Morcom, assistant superintendent, General Railway Signal Co., Rochester, N. Y., recently was promoted to factory superintendent, to succeed the late Frank H. Banner. Mr. Morcom was born in Jerry, Pa., and was graduated from Carbondale Commercial institute. He became piecework inspector at the Sayer shops of Lehigh Valley railroad in 1908 and later served as assistant toolroom foreman for General Railway Signal Co. During the World war he was division superintendent at the United States naval gun plant at Rochester, N. Y., and for the past 12 years has been with the General Railway Signal Co. as assistant production manager and assistant superintendent. Robert H. Parks, identified with the General Railway Signal Co. for some time past, has been made assistant superintendent to succeed Mr. Morcom.

Arnold Lenz, general manager, Chevrolet Gray Iron Foundry division, General Motors Corp., Saginaw, Mich., recently was appointed a member of the citizens' advisory committee on employment stabilization by Governor Wilber M. Brucker of Michigan.

Pichegru Woolfolk, associated with the Bartlett Hayward Co., Baltimore, founder and machinist, since his graduation in 1914 from the University of Virginia, has been appointed assistant general manager. He has served in all branches of its activities.

Lester A. Blackford, Montclair, N. J., who became affiliated with American Car & Foundry Co., St. Louis, in 1903, and who has been assistant treasurer since 1917, has been elected treasurer. He succeeds the late Stanley A. Mallette.

John L. Jones, formerly manager, Lansing Co., Lansing, Mich., and more recently associated with the foundry division of the Oakland Motor Car Co., Pontiac, Mich., has been appointed to the sales engineering staff of Great Lakes Foundry Sand Co., De-

John L. Jones

troit. He also was at one time connected with the Jahns Cylinder Grinding & Foundry Co., Los Angeles.

Walter C. Raithel, sales manager, foundry department, Century Electric Co., St. Louis, recently was elected president of the St. Louis Foundrymen's club, as announced in the June 15 issue of THE FOUNDRY. Mr. Raithel was born in St. Louis and received his education in the public schools and Washington university, St. Louis. For 14 years he was asso-

Walter C. Raithel

ciated with the St. Louis Malleable Casting Co. as assistant secretary in charge of sales costs and production. Later he was affiliated with the Mound City Foundry, St. Louis, for six years as general manager. During the past year and a half he has occupied his present position with the Century company.

Eugene Victor Ronceray, president and managing director, S. A. des Establissements Bonvillain et Ronceray, Paris, recently was elected senior vice president, French Foundry Technical association. Mr. Ronceray also is president and managing director, Universal System of Machine Moulding & Machinery Co. Ltd., London, and is director of studies at the Foundry high school, Paris. He has devoted the greater part of his life to foundry practice, and is one of the founders of the French Foundry Technical association of which he has been a vice president and member of the council since its foundation. He has presented many papers at foundry association meetings and

conventions and has written many articles for the technical press. He also has been active in the international foundrymen's congress. A member of many scientific and technical associations in various countries, he has received recognition from several organizations including the American Foundrymen's association which presented him with the J. H. Whiting gold medal. He is the recipient of honors both from the French government and that of Spain.

Ira C. R. Guldin, Kutztown Foundry & Machine Co., recently was elected a national director, National Association of Purchasing Agents.

Harrison Hoblitzelle, executive vice president, General Steel Castings Corp., Eddystone, Pa., has left for a trip to Europe extending over 6 weeks.

Fred G. Berling, Lunkenheimer Co., Cincinnati, has been re-elected vice president of the Cincinnati Association of Industrial Marketers.

Louis Sandler, works manager, Johnson Bronze Co., New Castle, Pa., has been promoted to vice president and in that capacity becomes assistant to **P. J. Flaherty,** president.

A. D. Lynch, personnel director, Ohio Brass Co., Mansfield, O., has been elected president of the National Foremen's association, in convention recently at Dayton, O. Mr. Lynch succeeds **W. J. Donkel,** of the Kent-Owens Machine Co., Kent, O.

Leo H. Booch, for the past 20 years, manager and president, Bridge & Beach Mfg. Co., St. Louis, which recently was reorganized, has returned to Dallas, Tex. He will resume his activity in the manufacturers' agency business in which he was engaged prior to 1911.

Harry A. Schwartz, manager of research, National Malleable & Steel Castings Co., Cleveland, and advisor on malleable cast iron to THE FOUNDRY, received the degree of chemical engineer from Rose Polytechnic institute, Terre Haute, Ind., June 13. Mr. Schwartz has received several degrees from the same institution, the bachelor of science degree in 1901, a master of science degree in 1903 and the professional degree of mechanical engineer in 1905.

Detroit Founders Hold Golf Tournament

Detroit Foundrymen's association held its first golf tournament of the season June 26, at the Beachwood Golf & Country club, Ontario. More than 50 members attended. Old Man Depression was buried after the game with appropriate ceremonies. A feature of the program were the Scotch songs sung by Bob Crawford, president, Atlas Foundry Co. and L. J. Rousseau, president, Commerce Pattern Foundry & Machine Co. Dr. Spindel, Springfield, Ill., gave a short address. The golf committee was composed of C. H. Miller, Standard Pattern Works and Babe Crawford, Atlas Foundry Co. Jesse D. Stoddard, vice president, Detroit Testing Laboratory, presented the prizes.

Enters Pulverized Fuel Equipment Field

Aubrey J. Grindle, pulverized fuel engineer, has been placed in charge of the new pulverized fuel equipment department of the Beardsley & Piper Co., 2541 North Keeler avenue, Chicago. The new department has been organized for the engineering, development and marketing of pulverized fuel systems for foundries and the industrial field generally. Activities of the department will include every phase of pulverized fuel system installation from engineering to the installed unit. Mr. Grindle is a pioneer in the pulverized fuel field and began experiments in this field in 1909. He has installed many systems both in the United States and Canada.

Aubrey J. Grindle

Stove Foundrymen Meet

Representatives of about 25 stove and furnace foundries in the Belleville, Ill., and St. Louis district met June 12 at the Hotel Belleville, Belleville, Ill., to exchange ideas and to increase prosperity of the stove and furnace industries. An organization is planned but no action was taken at the meeting. George Dana, Charter Oak Stove & Range Co., St. Louis, presided as chairman, and T. F. McCartney, secretary-manager, Belleville chamber of commerce, acted as secretary.

William A. Hamann has retired as chairman and director of the Roessler & Hasslacher Chemical Co. Inc., New York.

OBITUARY

Frank H. Banner, factory superintendent, General Railway Signal Co., Rochester, N. Y., for the past eight years, died recently.

Lloyd Johnson, 50, manufacturing director, Joubert & Goslin Machine Co., Birmingham, Ala., for many years, died recently. He was born in Brooklyn, N. Y.

Will F. Lewis, for the past 23 years superintendent of the roll designing department, Duquesne Steel Foundry Co., Coraopolis, Pa., died in Pittsburgh, June 23 at the age of 64. Mr. Lewis previously was connected with the Mackintosh-Hemphill Co., Pittsburgh, and Cambria Steel Co., Johnstown, Pa.

William S. Perrigo, 54, president, Northwestern Molding Sand Co., Beloit, Wis., and the Lakeside Railway Signal Co., Rockford and Freeport, Ill., died July 3 at Rochester, Minn. Mr. Perrigo also was connected with Woodruff & Edwards Co., gray iron foundry at Elgin, Ill. A native of Beloit, Mr. Perrigo at 18 began work at the Beloit plant of Fairbanks, Morse & Co., Chicago, and remained there for 27 years.

William L. Saunders, 74, chairman, Ingersoll-Rand Co., New York, died June 26 at Teneriffe, Canary Islands, while on a world cruise. He was an inventor of numerous engineering devices. He began his engineering career with National Storage Co., Communipaw, N. J. He later became engineer, vice president and president in turn, of Ingersoll-Sergeant Drill Co., and president of Haesler Tool Co. and New York Imperial Tool Co. When Ingersoll-Sergeant Co. was succeeded by Ingersoll-Rand Co. he became president and later chairman.

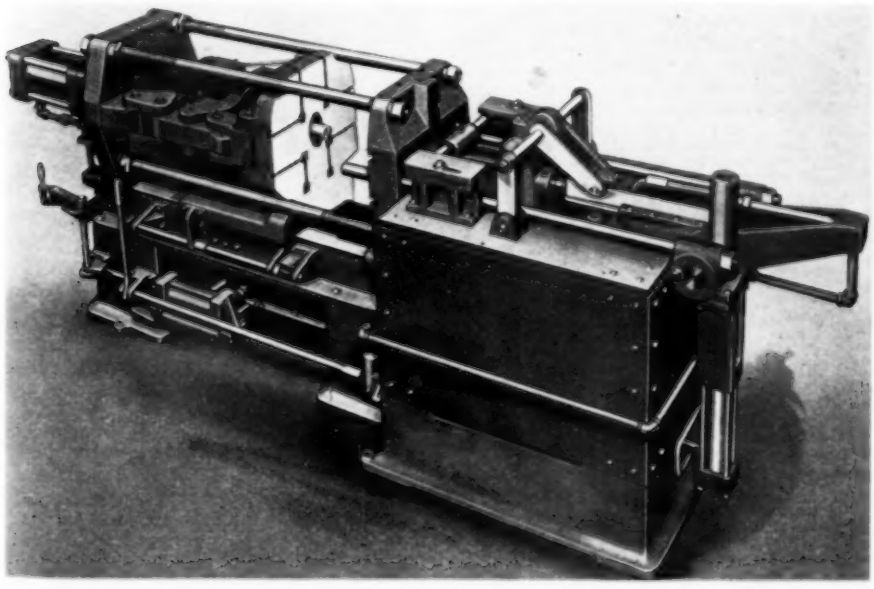
Bartlett M. Shaw, for 47 years connected with the manufacturing firm of Walker & Pratt, Watertown, Mass., and for the past 36 years general superintendent of the plant and director of the firm, died at his home 27 Oliver street, Watertown, June 21 after an illness of several month's. Through his long association with the one firm and through his many activities Mr. Shaw enjoyed a wide reputation, particularly among members of the New England Foundrymen's association of which he was a past president and consistently active member. He came from a family of molders and foundrymen engaged in that industry from revolutionary times. He was born in Carver, Mass., May 1, 1865. In 1884 he took service under his uncle the late Hon. Oliver Shaw, at that time superintendent of the Walker & Pratt plant, and in 1895 succeeded his uncle in that position. He was chairman of the Watertown selectmen in 1905 and 1906, chairman of the town's first finance committee and served until failing health prevented further activity as chairman of the committee of 100 who arranged the Watertown tercentenary celebration last year.

Operates Die Machine Hydraulically

Lester Die & Machine Co., 2810 Superior avenue, Cleveland, is manufacturing a new die casting machine which is operated hydraulically. An oil pump operates the hydraulic mechanism. Operating links are made of cast steel bushed with hardened bearings and pins with facilities for lubricating.

The machine is operated with two levers on the right hand side, one lever operating the oil and the other the air mechanisms. Interlocking safety devices protect the operator. Those devices are arranged so that it is impossible to have the dies open when the air pressure is applied. Die plates are machined with T-slots allowing the dies to be mounted quickly. The machines are made in four types and are semiautomatic. Automatically operated hydraulic cylinders for ejecting the castings from the dies and mechanisms for the automatic removal of cores during the opening stroke of the machine can be supplied on request.

The accompanying illustration shows one machine, the smallest of that type which the company manufactures. Specifications for that machine show that the die opens 8 inches; maximum die space, 17 inches; minimum die space, 6 inches; area between bars, 16½ x 12 inches; average shots per hour, 250; piston diameter, 4½ inches; piston stroke, 7 inches; capacity of gooseneck using aluminum, 7.5 pounds; pot capacity using aluminum, 250 pounds; locking pressure, 120,000 pounds; length 10 feet 8 inches; height, 50 inches; width 42 inches and shipping weight, 6500 pounds. The largest type machine of that class has a gooseneck capacity of 18½ pounds, makes 75 castings per hour, has a maximum die space of 34 inches and a minimum of 16 inches and has a locking pressure of 250,000 pounds. Reed-Prentice Corp., 41 Broad street, New York, is the sales agent for the line of die casting machines.



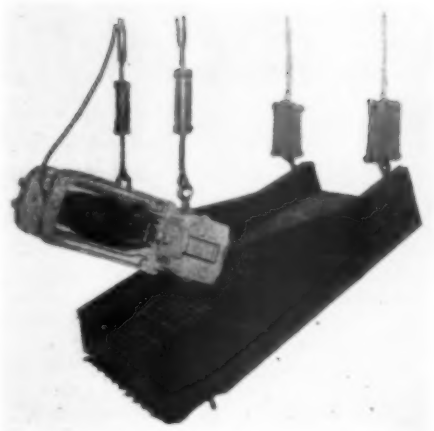
Machines Are Operated by Two Levers on the Right Hand Side of the Machine, One Controlling the Oil and the Other the Air Mechanisms

Sand Flows Over Screen By Gravity

The Traylor Vibrator Co., Denver, Colo., has introduced a combination screen and vibrator. The vibrator unit is mounted above the screen sash and imparts vibration at an angle to the screening plane. Rapid oscillation produces a sharp screening action as well as a conveying motion. The screen may be operated practically flat and, therefore, the necessity of setting the screen at an angle where gravity will cause the flow of the material across its surface is overcome.

Power units which vibrate the sash are the same type and design as those used on vibrating conveyors made by the company. The vibrator is suspended so that all the vibration is absorbed within the unit and none is transmitted to building supports. The power unit takes its energy from any standard alternating current and through the use of a small motor generator set, supplied with the screen, the intensity of the vibration is under rheostat control and may be varied to meet individual requirements. The screen is supplied in four standard widths and in any length necessary to accomplish the duty. On single and double deck screens up to six feet long, one vibrator is used; on screens over 6 and up to 12 feet long, two vibrators are used; and on screens over 12 feet in length, three or more vibrators are used to oscillate the screen sash.

The steel sash of the screen, over which the screen cloth is stretched tightly, is vibrated as a unit. All cross ribs for support of the screen cloth, are equipped with specially molded rubber strips which are claimed to protect and prolong the life of the screen cloth. A complete renewal of cloth can be made without special tools in 10 minutes. The accompanying illustration shows one of the new type units.



Number of Vibrators Used Depends Upon the Length of the Screen

Unloader Is Improved

Link-Belt Co., Philadelphia has made several changes in its portable loader known as the cub. Changes in designs are said to improve the durability and lessen the weight of that machine. In addition to the lightening of the new model 100 pounds, it is equipped with a conveyor belt 18 inches wide, all metal troughing rolls with roller bearings, bronze bushed shaft bearings, and a 9-inch diameter head pulley which is designed to pull without slipping. The unit is driven with a well protected, ball bearing, electric motor. The drive is transmitted by cut gears and a short drive chain. A special method of lubrication is used throughout. Other changes include a convenient crank for operating a self-locking worm and wheel, an improved boot with belt guide, and new type wheels.

Nominates Officers

The American Society of Mechanical Engineers recently nominated the following members as officers of the society: Conrad N. Lauer, president; Robert M. Gates, William B. Gregory, Fred H. Dorner and Charles M. Allen, vice presidents; and Eugene W. O'Brien, Harry R. Westcott and Alexander J. Dickie, managers.

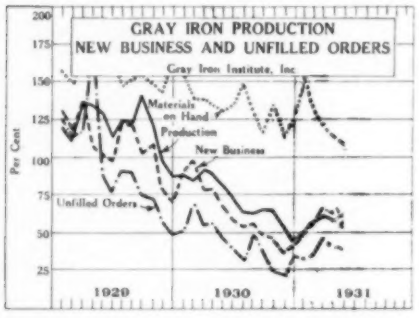
Fort Pitt Flask Equipment Co., Pittsburgh, has been organized by C. H. Curry, Coraopolis, Pa., president; H. J. Koch, Pittsburgh, vice president; and C. S. Koch, Edgewood, Pa., treasurer, with $250,000 capital to manufacture foundry flasks.

Trade Trends in Tabloid

IMPROVEMENT in business conditions is apparent, in several industries, including automobile, chemical, machine tool, electric power, textile, commercial bakery, furniture, building construction, meat packing, shoe retailing and radio broadcasting, according to a recent report of members of the National Conference of Business Paper Editors and the Associated Business Papers.

—T—T—

Seasonal influences have developed further slight declines in numerous foundries. Information from various sections indicate this condition is not



general, for here and there foundries have been increasing operations steadily since March or April, and now are working in the neighborhood of capacity.

—T—T—

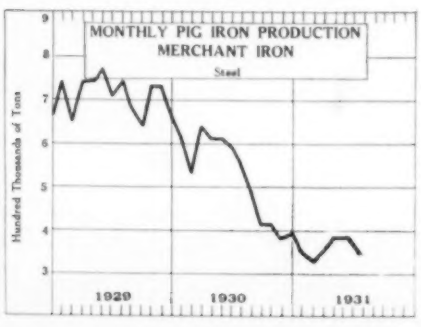
Automobile production declined gradually during the last half of June, and no indications were present that the condition would be changed in July. *Steel* estimates that production in June was 275,000 units compared with 315,000 in May.

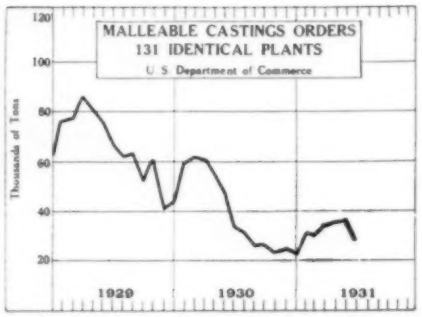
—T—T—

Orders for steel castings, according to the department of commerce, totaled 39,044 tons in May compared with 46,007 in April. Production of steel castings declined from 48,250 tons in April to 43,141 tons in May.

—T—T—

Early July foundry operations in the Chicago area dropped to approximately 25 per cent. Vacation shutdowns during and following the holiday were exceedingly numerous this year. A few of the plants are expect-





ing moderate improvement in schedules during the late summer and early autumn. Implement and tractor plants, on the other hand, are not expected to realize marked improvement until around the first of the year.

—T—T—

Production of malleable castings in May totaled 31,344 tons compared with 36,076 tons in April, according to the department of commerce. Orders were 28,208 and 36,086 tons respectively.

—T—T—

Orders for bath tubs in May totaled 43,006 tons, a gain of 3000 over the preceding month, according to the department of commerce. Orders for sinks called for 54,448 units, a gain of 2000.

—T—T—

Production of gray iron castings by members of the Gray Iron institute, Cleveland, was 60.7 per cent of normal in May compared with 58.2 per cent in April. New business dropped

RAW MATERIAL PRICES

July 8, 1931

Iron	
No. 2 foundry, Valley	$17.00
No. 2 Southern, Birmingham	12.00 to 13 00
No. 2 foundry, Chicago	17.50
No. 2 foundry, Buffalo	17.00
Basic, Valley	17.00
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	17.50
Malleable, Buffalo	17.50
Coke	
Connellsville beehive coke	$3.25 to 4.50
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$11.00 to 11.50
Heavy melting steel, Pitts	10.00 to 10.50
Heavy melting steel, Chicago	8.50 to 9.00
Stove plate, Buffalo	7.75 to 8.00
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	8.75 to 9.25
No. 1 cast, Philadelphia	11.50 to 12.50
No. 1 cast, Pittsburgh	10.00 to 10.50
No. 1 cast, Birmingham	9.00 to 10.00
Car wheels, iron, Pittsburgh	10.50 to 11.00
Car wheels, iron, Chicago	10.00 to 10.50
Railroad malleable, Chicago	9.50 to 10.00
Agricultural mal., Chicago	9.00 to 9.50
Malleable, Buffalo	10.00 to 10.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.12½
Straits tin	26.12½
Aluminum, No. 12, producers	22.00
Aluminum, No. 12, remelt	9.00 to 10.50
Lead, New York	4.40
Antimony, New York	6.87½ to 7.00
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.95 to 4.00

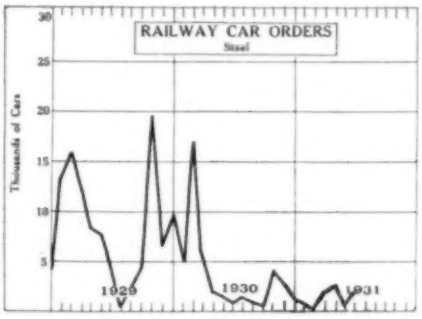
from 60.9 per cent in April to 51.2 per cent in May.

—T—T—

Index or orders for foundry equipment in May was 54.1 compared with 57.7 in April, according to the Foundry Equipment Manufacturers association. Index of shipments increased from 69.7 in April to 118.6 in May.

—T—T—

Of the members of the Steel Founders Society of America reporting to that organization, 69.0 per cent are operating below 50 per cent of capacity, 17.2 per cent from 50 to 59 per



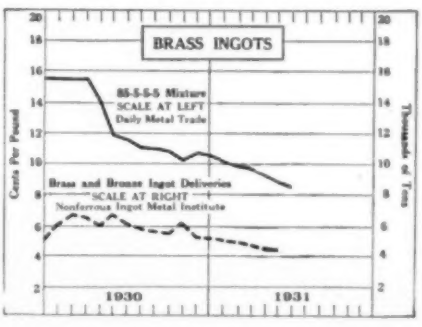
cent, 8.7 per cent from 60 to 69 per cent, 3.4 per cent from 70 to 89 per cent and 1.7 per cent over 100 per cent. The majority of reports indicate that the business outlook is good.

—T—T—

Operations of gray iron foundries in the Pittsburgh district have been fairly steady, June schedules generally having held around the rate of late May. Output is at a low level, averaging around 25 per cent, with most plants pouring no more than two days a week. Decreases compared with early spring activity are noted in manufacturing as well as jobbing lines. Steel foundry operations are off slightly from the rate a month ago.

—T—T—

Average New York prices for nonferrous metals during June, according to *Daily Metal Trade*, were as follows: Casting copper, 8.072c; electrolytic copper, 8.276c; Straits tin 23.445c; lead, 3.919c; antimony, 6.26c; aluminum, 98-99, 22.90c. Zinc averaged 3.409c, East St. Louis, Ill.



What Others Are Thinking

Abstracts Selected from European Foundry Literature

Gives Iron Properties

Cast Iron, Its Qualities and Defects (La Fonte de Fer, Ses Qualities, Ses Defauts) by L. F. C. Girardet. *La Fonderie Belge*, Liege, April, 1931.

Properties of cast iron are governed primarily by the structure of the metal, and this factor is discussed in relation to; (a) high-duty cast iron; (b) corrosion-resisting cast iron; (c) heat-resisting cast iron.

High-duty cast iron must have fine graphite, which should not be too abundant, and which should be well distributed in the mass. In addition, the matrix should be homogeneous and of fine texture. It is advisable to have a comparatively low total carbon, either by using low carbon irons or by adding steel scrap to the charges.

To secure fine graphite it is necessary; (a) to avoid graphite flakes; (b) that the iron should have a high degree of fluidity; (c) that all the elements should be well dissolved in the metal, or at least in the form of a fine emulsion. The fact is emphasized that high temperatures can be attained in the cupola. A temperature of 1700 degrees Cent. (3100 degrees Fahr.) can be reached easily if the cupola is normal and normally operated.

Study Phosphorus Formation

The Influence of Silicon Content and the Cooling-speed upon the Constitution of the Phosphide Eutectic in Cast Iron (Der Einfluss des Siliziumgehaltes und der Abkeuhlungsgeschwindigkeit auf die Konstitution des Phosphideutektikums im Gusseisen), by Peter Bardenheuer and Martin Kuenkele, *Die Giesserei*, Dusseldorf, Germany, May 22, 1931.

To determine the effect of silicon on the form of the phosphide eutectic in cast iron two types of iron melted in high frequency electric furnaces were used. One was manganese free, while the other contained about 0.7 per cent manganese. The phosphorus content in all specimens was around 2 per cent and the silicon was varied from 0.12 to 6 per cent in steps of approximately 1 per cent. Wedge-shaped test pieces approximately 1.5 x 2 x 10 inches tapering to 0.25 inches were used.

It was found in manganese-free, iron-phosphorus-carbon alloys that with up to 2 per cent silicon the metastable, ternary phosphide eutectic was formed with the constituents cementite, iron phosphide and solid solution. Those limits hold good under the assumption that freezing conditions and chemical composition of the described relations are the same. Slight increase in silicon above that mentioned causes the formation of ternary and pseudobinary phosphide eutectic together. As the silicon content increases, the pseudobinary eutectic increases at the expense of the ternary compound until at over 3 per cent silicon, only the pseudo form exists in the cast iron.

With 0.7 per cent manganese, the limits mentioned for the manganese-free alloys are less markedly apparent. The conversion follows the same particulars as for the manganese-free alloys, and when the silicon content is higher than 3 per cent only pseudobinary phosphide is present. Slow cooling favors the freezing of the ternary alloy according to the stable iron-graphite-iron phosphide system and in consequence of the separation of graphite, leads to the formation of the pseudobinary phosphide eutectic.

Investigates Air Pressures

The Rational Operation of Cupolas, (La Conduite Rationnelle des Cubilots) by M. MacKinney. *La Revue de Fonderie Moderne*, Paris, April 10, 1931.

It is an error to believe that the volume of air, and the pressure can be controlled simultaneously by the register placed on the line between blower and cupola. The relation between pressure and volume is primarily a function of conditions which exist inside the cupola. It also is wrong to believe that the pressure in the wind belt depends upon the number and the total section of the tuyeres. That pressure is dependent, almost entirely, upon conditions inside the cupola and resistance resulting from the charges.

There is a maximum temperature which it is possible to obtain with air and coke. A definite volume of air is necessary to obtain this temperature in a given cupola. If the volume is less, the maximum temperature is not obtained, because combustion is incomplete. If the volume of air is in excess of the amount required, the maximum temperature is not obtained, because the excess of air has a cooling effect. Maximum temperature of molten metal will be obtained with maximum temperature and height at the melting zone. Maximum temperature of the melting zone will only be obtained if the volume of air is correct. On the other hand, maximum height of the melting one is limited by pressure obtainable with a given blower.

If the volume of air entering the cupola is decreasing, the quantity of coke should be decreased. If the volume of air increases, it is necessary to close the register and increase the charges of coke until the optima conditions again have been reached.

Fuel consumption depends principally on three factors: Use of the optimum volume of air; height between the level of the tuyeres and top of the cupola; and required metal temperature at the tap-hole. Results of experiments on a number of cupolas tend to show that the optimum volume of air, including losses, is 150 cubic meters per minute and per square meter of the inside section of the cupola at the level of the melting zone. The greater the diameter of the cupola, the more pressure will be required to pass the necessary volume of air for a given height of the melting zone, but the increase in pressure is not proportionate to the increase in diameter of the cupola. Contrary to what generally is believed, when the optimum volume of air is employed, the speed of melting does not vary if the percentage of coke is increased, or if a substantial charge of steel is used.

Withstand High Temperatures

Cast Alloys for High Temperature Service, by Prof. D. Hanson, University of Birmingham, *Foundry Trade Journal*, June 4, 1931.

The chief requirements for materials for high temperature service are mechanical strength and chemical resistivity, with the latter the more important generally. Many variables enter the selection of materials for those services. One material may give excellent service under one set of conditions while it would be of no value under another set. Any metal or alloy is resistant chemically at high tempertures only with reference to the particular conditions under which it is used.

Surface stability in metals and alloys at high temperatures may be due to intrinsic inertness under conditions of exposure and the formation of adherent impervious layers of reaction product between the alloy and the corrosive environment which prevents further action. Chromium and aluminum alloys are examples of the latter type. The metallic constituents of alloys appear to confer some of their properties on the alloy. The degree of the properties conferred depends upon the amount of alloy used. For those totally miscible, a 50-50 alloy appears to give maximum strength. Generally alloys are not completely soluble in each other. In that case, the strongest alloy is found at the limit of solid solubility.

Many factors influence the application of alloys in heat resistant installations. In general, strength of an alloy decreases as the temperature rises. At high temperatures, metals have practically no elasticity, and they tend to flow depending on the grain size of the material.

Castings show better properties for heat resistant installations than rolled materials. It is easy to produce intricate sections in castings, they are more stable, they are not subject to the same kind of grain growth as rolled sections, they are stronger under creep conditions and the rate of flow of castings is less than that of wrought sections.

Heat resisting materials are divided into those with iron and nickel bases and the cast irons and steels. In general, heat resisting alloys may be regarded as nickel-iron-chromium alloys. Tungsten, molybdenum, silicon and other elements are used in conjunction with those alloys to stiffen the metals. Some of the alloys used for heat and corrosion resistance are discussed.

What the Foundries Are Doing

Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

Andes Inc., Lancaster, Pa., has discontinued business and the equipment is being sold.

East Akron Castings Co., 79 Kelly avenue, Akron, O., recently installed new equipment in its foundry.

Great Lakes Brass Foundry, 1305-07 Madison avenue, Bay City, Mich., is making brass castings.

McPherson's Aluminum & Brass Foundry, 1218 Elati street, Denver, makes brass and aluminum castings.

Kenton Foundry Co., 116 Willis street, Portland, Oreg., manufactures gray iron, brass and aluminum castings.

Skolil Foundry, 463 East Alder street, Portland, Oreg., operates a foundry for the manufacture of gray iron castings.

An aluminum foundry has begun operations in the plant formerly occupied by the Bryan Plow Works, Bryan, O.

Chicago plant of the American Car & Foundry Co., New York, has added 400 men to the pay roll.

The plant of the Lynchburg Foundry Co., Anniston, Ala., recently was damaged to the extent of $10,000.

Wincroft Stove Works, Middletown, Pa., is starting operations after being shut down for 3 months.

Bond Foundry & Machine Co., Manheim, Pa., reports an improvement in business. The foundry is working 5 days a week.

Sparta Foundry Co., Sparta, Mich., will spend $18,000 for improvements to its production facilities. T. E. McFell is president.

Central Brass Foundry, 369 Grand street, Portland, Oreg., succeeds the Central Bronze Foundry at the same address.

Freed Heater Co., West Third avenue, Collegeville, Pa., has discontinued business and its buildings and equipment are for sale.

P. F. Schumann Aluminum Match Plate Foundry, 526 Spring street, Fort Wayne, Ind., is a maker of aluminum castings.

Enterprise Brass Works, 1401 Block street, Baltimore, manufactures gray iron, brass and aluminum castings and operates a pattern shop.

Edmund G. W. Jost, 81 Clay street, Newark, N. J., makes brass and aluminum castings and operates a machine shop.

Pacific Mills Ltd., Ocean Falls, B. C., makes gray iron, brass and aluminum castings and maintains machine and pattern shops and a laboratory.

Operations in the wheel foundry department of the Lenoir City Car Works, Lenoir City, Tenn., have been resumed.

J. J. Ryan & Co., 104 South Jefferson street, Chicago, has moved its manufacturing plant to a 1-story building at 4301-05 West Kinzie street.

Columbia Malleable Castings Co., Columbia, Pa., subsidiary of the General Fire Extinguisher Co., is working full time at full capacity.

New Holland Brass, Bronze & Aluminum Co., New Holland, Pa., reports that business is good and steadily improving. The plant is working at full capacity.

M. Greenberg's Son's Brass Foundry & Machine Works, 765 Folsom street, San Francisco, makes brass and aluminum castings and operates machine and pattern shops.

Hybnickel Alloys Co., Wilmington, Del., specializes in steel castings and operates machine and pattern shops and a laboratory. The company succeeds Victor H. Hybinette.

DeHart Machinery & Foundry Co., Memphis, Tenn., has received contracts for construction of sewer and street castings from the city of Memphis for the next 12 months.

General Fire Extinguisher Co., Providence, R. I., has purchased the interest of the late L. R. Zifferer, in the Columbia Malleable Castings Corp., Columbia, Pa.

General Bronze Corp., 3849 West Lake street, Chicago, has been awarded the subcontract for supplying miscellaneous material for the University of Chicago field house.

Standard Pattern Works, 6425 Charlevoix avenue, Detroit, has been incorporated with $15,000 capital by Clarence A. Miller, 13966 Terry avenue, to engage in a general machine and foundry business.

Kendallville Foundry Co., West North street, Kendallville, Ind., recently was struck by lightning and damaged to the extent of $500. An undetermined amount of damage was done to patterns in the foundry.

Paramount Bronze & Steel Co., 4-73 Forty-eighth street, Long Island, N. Y., has been organized to succeed the Paramount Kalamein Corp. The company makes gray iron, brass and bronze castings and operates a machine shop.

Lacer Corp., 1224 East Eighth street, Los Angeles, succeeds the Lacer-Hallett Corp. The company makes gray iron, brass and aluminum castings. Another plant is operated at 523 Redmonde boulevard, Inglewood, Calif.

Barnes Mfg. Co., Mansfield, O., has rented a 1-story building with 16,000 square feet of floor space at Pershing road and Wallace street, Chicago, as a warehouse and distribution point for plumbing and heating supplies.

National Steel Casting Co., Montpelier, Ind., will expand its plant facilities. An open-hearth furnace will be installed. Alternative plans call for construction at the present plant or at the plant of the Chemical Equipment Co.

Alliance plant of the American Steel Foundries recently resumed operations.

J. C. Haimerl and F. F. Koehler have been operating the Baraboo Gray Foundry Co., Baraboo, Wis., in a building formerly owned by the Chicago Northwestern railroad.

Oakley Valve & Foundry Co., 62 Ferguson street, Newark, N. J., has moved to new quarters at 21 Newark way, Maplewood, N. J., and has changed its name to the Dura Motor Valve Corp. There will be no change in management.

Sharon plant of the American Steel Foundries has been sold to H. B. Small, Wheatland Tube Co., Sharon, Pa., who plans to develop a new industry. The plant formerly values at practically a half million dollars, was sold for $25,000.

Jenkins Bros. Ltd., 617 St. Remi street west, Montreal, Que., has let the contract to A. F. Byers & Co. Ltd., 1226 University street, Montreal, for the erection of a foundry between Rockfield and Dominion streets, Lachine, Que. The cost is estimated at $245,000.

Griffith-Chamberlain Inc., Oneida, N. Y., recently organized with $40,000 capital by Henry G. Griffith, 403 Ransom avenue, Sherrill, N. Y., and Frank W. Chamberlain, 417 Franklin street, Oneida, N. Y., will operate a foundry for the production of stoves, furnaces and parts.

Interstate Bronze & Mfg. Co., 740 South Broadway, Los Angeles, operates a foundry for the manufacture of brass and aluminum castings and maintains machine and pattern shops. The company is engaged in a highly specialized work and operates its own plating and finishing plants.

Delco-Remy Corp., Bu-nite piston plant, 3234 West Washington street, Indianapolis, is being moved to Anderson, Ind. This will allow increased research and manufacturing facilities. The manufacturing branches will be included as Delco-Remy plant No. 5 and the engineering and research laboratories will be located in the general administration building. (Noted July 1.)

Summit Newton Foundry Co., Barberton, O., has been reorganized by John Donald, John Binns and J. G. Metzler. The company now is known as the Newton Brass Foundry & Pattern Works and is producing brass and aluminum castings and wood and metal patterns. John Donald is manager of the new firm.

Property of the Enterprise Foundry Co., 2826 Highland avenue, Kansas City, Mo., has been condemned for a city park improvement. The equipment and business of the Enterprise company has been purchased by the Pugh Foundry Co., Kansas City. James F. Stack, formerly of the Enterprise company will be in charge of the coreroom of the Pugh Foundry Co.

Foundries in Port Huron, Mich., are active. Holmes Foundry Co., Little Bros. Foundry Co., and the United Brass & Aluminum Co. all are working on contracts from the Chrysler Corp. The Holmes company is making 425 cylinder blocks per day for the new Plymouth model of Chrysler. The United Brass Co. is reported as having said that it had 20 to 30 per cent more business in June than during the previous few months.

United Engineering & Foundry Co., 1400 Grace street, Canton, O., is building a 60-foot addition to its foundry. The addition is of brick and steel construction and will increase the length of the building to 560 feet. The company also is making improvements in

equipment. Another air-furnace is being installed giving a total of three. The additions and improvements will increase the production 30 per cent. John Quinn is works manager.

Hill-Clutch Machine & Foundry Co., Cleveland, has acquired the Cleveland Knife & Forge Co., Cleveland, and will consolidate the manufacturing facilities of the latter at the plant of the former at 6400 Breakwater avenue. The plant of the Cleveland Knife & Forge Co. at 1960 West 114th street, will be offered for sale. Ralph Perkins, formerly president of the Hill company will be president of the new company, A. C. McDaniel, former head of the Cleveland company will be vice president and general manager. Other officers include H. S. Donaldson, vice president, John R. Short, secretary and M. G. Firestone, treasurer.

Utilities Foundry Co., Tonawanda, N. Y., has been formed for the production of castings for the utilities industry and for water and street departments of municipalities. The foundry formerly was a part of the Gillie Machine Co., Tonawanda, N. Y., but will have no direct connection with that company in the future. Molding machines and other equipment are in the process of installation. The new company is working 5 days per week. For the past 4 weeks orders have exceeded the plant's producing capacity. Officers of the company are: Arthur Whitcraft, president; Edward Beiswanger, vice president in charge of operations; Alfred J. Schwartz, secretary-treasurer; Norris Whitcraft, sales mananger; and Joseph Clifford, metallurgist.

Maher Iron Works, Jamestown, N. Y., is having plans prepared by the Austin Co., Cleveland, for a foundry and machine shop to be located at 20-24 Taylor street, Jamestown. Five years ago, the Maher Iron Works purchased the Jamestown Iron Works. At that time, the Maher company discontinued the manufacture of castings at its Taylor street plant but continued to operate its machine shop there. Castings were made at the 11 Shearman place plant. The new buildings will be for a company known as the Jamestown Iron Works, the name of the Maher Iron works being discontinued. The new shops will be equipped with a 36-inch and a 46-inch cupola for the production of gray iron castings. Bronze and aluminum castings also will be made.

New Trade Publications

HEAT TREATING—Vincent Steel Process Co., Detroit, Mich., has issued a booklet on scientific heat treating for use of persons interested in this subject.

CAR PULLERS—Illustration and description of capstan and drum-type car pullers are contained in a folder issued recently by the Webster & Weller Mfg. Co., Chicago. Operating advantages and possible savings are discussed.

GANTRY CRANES—A current folder from Cleveland Electric Tramrail, division of the Cleveland Crane & Engineering Co., Wickliffe, O., illustrates and describes single or double-leg gantry cranes in typical shop and foundry applications.

CHROME CEMENT—A folder on its multi-bond chrome cement has been issued by E. J. Lavino & Co., Bullitt building, Philadelphia. Illustrations and descriptions indicate its use in various industries. Details of the action of this cement are analyzed.

APRON FEEDER—Illustrations of typical applications of a heavy-duty, manganese steel, apron feeder feature a folder recently issued by Link-Belt Co., 910 South Michigan avenue, Chicago. Details of construction and specifications are outlined and illustrated.

BAND SAW—Description and illustration of a recently-introduced, metal-cutting, band saw is contained in a folder issued by William Laidlaw, Inc., Belmont, N. Y. Specifications of the machine including hydraulic feed are covered and typical examples of work done are illustrated.

FIRE CLAY—An increasing demand for steel castings is pointed out in a recent folder from Illinois Clay Products Co., Joliet Ill., which recommends its products to resist the high temperatures of steel melting and molding. Successful use of its products, a list of which are given, in steel foundries is described as an index of their worth.

OIL BURNERS—Low pressure oil burners with auxiliaries are described in a bulletin recently issued by Ryan, Scully & Co., Philadelphia. General operating principles are outlined and various types of burners are illustrated. A table of burner sizes and air pressures is included.

DIE CRACKS—Determination of the causes of cracks in hardened and ground tool and die steels was the aim of a series of tests conducted by Norton Co., Worcester, Mass. A recent booklet from the company reports on the tests and compares heat treatment with surface grinding as causes for the cracks.

ROLLER CHAIN—Ideas calculated to simplify and improve machine design by the use of roller chains made by the Diamond Chain & Mfg. Co., Indianapolis, are contained in an illustrated booklet recently issued by that company. Use of the chain in eight types of drive is illustrated by typical examples taken from practice.

STEEL LOCKERS — A broadside from the Durabilt Steel Locker Co., 600 Arnold avenue, Aurora, Ill., describes and illustrates improvements made in steel lockers built by the company. Detail specifications are given and features of the design are illustrated. The lockers are adapted to factory, home, or office.

MOTORS — Squirrel-cage induction motors of a new, W-frame type are described in illustrated leaflet recently issued by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Interchangeable mechanical and electrical parts are a feature of the construction. Applications of the motors, made possible by the special construction, are outlined.

INDUSTRIAL TRACTORS—A recent bulletin from Clark Tructractor Co., Battle Creek, Mich., illustrates and describes the 4-wheel, gasoline-powered industrial tractors made by the company. Gasoline-powered shovels and cranes for factory use also are covered. The shovel is recommended to foundries for material handling, clean up, and waste removal.

PYROMETERS—A catalog recently issued by the Brown Instrument Co., Philadelphia, describes and illustrates indicating, recording, controlling, multiple-recording, and multiple-controlling potentiometer pyrometers made by the company. Operating principles are explained in full and individual instruments are described in reference to applications.

INDUSTRIAL HEATING — Reznor Mfg. Co., Mercer, Pa., has issued a bulletin describing its gas-fired, warm air, forced circulation heaters adapted to factory, auditorium, or warehouse heating. Design and construction are illustrated and notes on operation and performance given. A second booklet is devoted to gas fired, warm air, heating and ventilating units.

AIR COMPRESSORS—An outline of a competitive test of four different types of air compressors is given in a bulletin recently issued by the Davey Compressor Co., Inc., Kent, O. Advantages of a 142 cubic foot capacity, air cooled compressor made by that company, as shown by the tests, are explained in full. Various mounting adaptations of the compressor are illustrated.

ALLOY STEEL CASTINGS—Corrosion resistance and technical data are given for chrome-nickel and special alloy castings made by the Duriron Co., Inc., Dayton, O., in a recently issued bulletin. Illustrations show typical castings, and chemical resistance and physical properties are outlined in tables. Machining, welding, and heat treatment are discussed.

COAL BURNER—Fuller Lehigh Co., 85 Liberty street, New York, has issued a folder, describing a circular burner made for pulverized coal. The burner is illustrated and advantages of its application, construction, and operation are pointed out. The burner is of the turbulent type.

POWER TRANSMISSION — Positive drives in seven types are described in an illustrated booklet recently issued by Link-Belt Co., 910 South Michigan avenue, Chicago. These include silent chain drives, roller chain drives, herringbone gears, herringbone speed reducers, steel and malleable chains, worm gear reducers, and variable speed reducers. Typical applications of each are illustrated.

LIFT TRUCK—Gasoline-powered, industrial lift trucks adapted to meet a wide variety of applications are described in a bulletin recently issued by Clark Tructractor Co., Battle Creek, Mich. Of particular interest to foundrymen are the low-platform trucks built for handling heavy materials, and the oven-charger truck designed for malleable iron foundries. Typical applications are illustrated.

METALLOGRAPHIC POLISHING MACHINES — American Instrument Co. Inc., 774 Girard street N.W., Washington, has issued a bulletin on its automatic metallographic polishing machine. The device is based on a similar machine developed by the bureau of standards to effect standardization of methods employed in polishing specimens for microscopic examination. The bulletin is illustrated and the machine is fully described.

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Linde Air Products Co., 30 E. 42nd St., New York City.
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Curtis Pneumatic Machinery Co., 1573 Kienlen Ave., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.

AIR SEPARATORS—See Separators—Air, Moisture, Oil

AIR TOOLS—See Tools—Pneumatic

ALKALI
Mathieson Alkali Wks., Inc., The, 250 Park Ave., New York City.

ALLOYS
Electro Metallurgical Sales Corp., 30 E. 42nd St., New York City.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

ALUMINUM
British Aluminium Co., 122 E. 42nd St., New York City.

ALUMINUM—Alloys and Ingots
British Aluminium Co., 122 E. 42nd St., New York City.

ANNEALING OVENS—See Ovens—Annealing

ARCHITECTS—Industrial
Austin Co., The, 16112 Euclid Ave., Cleveland, O.

ARC WELDING EQUIPMENT
General Electric Co., Schenectady, N. Y.

ARRESTORS & COLLECTORS—Dust—See Dust Arresting and Collecting Systems

BABBITT METAL
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BAND SAWS—See Saws

BARROWS—Foundry
Sterling Wheelbarrow Co., Milwaukee, Wis.

BARS—Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.

BELLOWS—Molders
Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

BINDERS—See Core Binders

BLOWERS
General Electric Co., Schenectady, N. Y.

BOLTS AND NUTS
Bethlehem Steel Co., Bethlehem, Pa.

BOND—Molding Sand
Great Lakes Foundry Sand Co., Penobscot Bldg., Detroit, Mich.

BOOKS—Technical
Penton Publishing Co., Cleveland.

BOTTOM PLATES—Steel
Shanafelt Mfg. Co., Canton, O.
Truscon Steel Co. (Pressed Steel Div.), 6114 Truscon Ave., Cleveland, O.

BOXES (Tote)
Sterling Wheelbarrow Co., Milwaukee, Wis.

BRONZE—Manganese
Ajax Metal Co., 46 Richmond St., Philadelphia, Pa.

BRUSHES
Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

BRUSHES—Motor and Generator
General Electric Co., Schenectady, N. Y.
United States Graphite Co., Saginaw, Mich.

BRUSHES—Wire
Osborn Mfg. Co., Inc., 5401 Hamilton Ave., Cleveland, O.

BUCKET CARRIERS—Pivoted
Milwaukee Electric Crane & Hoist Corp., Milwaukee, Wis.

BUCKET LOADERS FOR Sand Mills
National Engineering Co., 549 W. Washington Blvd., Chicago, Ill.

BUCKETS
Penn Foundry & Mfg. Co., Reading, Pa.

BUCKETS—Clamshell, Dragline, Grab
Brosius, Edgar E., 19th St. & P. R. R., Sharpsburg P. O., Pittsburgh, Pa.
Harnischfeger Corp., 3800 National Ave., Milwaukee, Wis.

BUCKETS—Electric
Erie Steel Construction Co., Erie, Pa.

BUCKETS—Line
Milwaukee Electric Crane & Hoist Corp., Milwaukee, Wis.

BUILDINGS—Foundry, Factory, Industrial
Austin Co., The, 16112 Euclid Ave., Cleveland, O.

BURNERS—Acetylene—See Torches and Burners—Acetylene, Blow, Oxy-Acetylene

BURNERS—Oil or Gas
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.

BUSHINGS—Flask Pins
Michigan Screw Co., Lansing, Mich.

CALCIUM—SILICON
Electro Metallurgical Sales Co., 30 E. 42nd St., New York City.

CALCIUM CARBIDE
Linde Air Products Co., 30 E. 42nd St., New York City.

CALKING HAMMERS—Pneumatic
Independent Pneumatic Tool Co., 600 W. Jefferson Blvd., Chicago.

CARBIC
Linde Air Products Co., 30 E. 42nd St., New York City.

CARBIDE
Linde Air Products Co., 30 E. 42nd St., New York City.

CARS—Annealing, Billet Furnace Charging, Core Oven, Pig iron
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.

CARS—Platform, Industrial Railway, Transfer, Narrow Gage
Bethlehem Steel Co., Bethlehem, Pa.
Foundry Equipment Co., The, 1831 Columbus Rd., Cleveland, O.
Penn Foundry & Mfg. Co., Reading, Pa.

CARS & Locomotives—Industrial
Industrial Equipment Co., The, Minster, O.

CASTINGS—Gray Iron
Bethlehem Steel Co., Bethlehem, Pa.

CEMENT—Furnace
Alpha-Lux Co., Inc., 192 Front St., New York, N. Y.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

CEMENT—High Temperature Refractory
Alpha-Lux Co., Inc., 192 Front St., New York, N. Y.

CEMENT—Metallic
Shanafelt Mfg. Co., Canton, O.

CHAPLETS
Shanafelt Mfg. Co., Canton, O.

CHARGING EQUIPMENT—Air Furnace
Euclid Crane & Hoist Co., The, 1364 Chardon Rd., Euclid, Ohio.

CHEMICALS
Mathieson Alkali Wks., Inc., The, 250 Park Ave., New York City.

CHIPPERS—Pneumatic—See Hammers—Chipping and Riveting, Pneumatic

CHISEL—BLANKS—Pneumatic
Independent Pneumatic Tool Co., 600 W. Jefferson Blvd., Chicago.

CHROMIUM
Electro Metallurgical Sales Co., 30 E. 42nd St., New York City.

CLAMPS—Hose—See Hose Clamps

CLAY—Fire—See Fire Clay

COAL
Hanna Furnace Corp., The, Detroit, Mich.

COAL CRUSHERS and Pulverizers
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.

COAL—ORE—ASH Handling Machinery
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland.
Harnischfeger Corp., 3800 National Ave., Milwaukee, Wis.
Milwaukee Electric Crane & Hoist Corp., Milwaukee, Wis.

COKE
Bethlehem Steel Co., Bethlehem, Pa.
Great Lakes Foundry Sand Co., Penobscot Bldg., Detroit, Mich.
Hanna Furnace Corp., The, Detroit, Mich.
Semet-Solvay Co., 61 Broadway, New York City.

COMPRESSORS—Air—See Air Compressors

CONSTRUCTION—Foundry Building—See Buildings—Foundry, Factory, Industrial

CONTRACTORS—See Engineers and Contractors

CONVEYERS—Belt
Bartlett, C. O., & Snow Co., 6201 Harvard Ave., Cleveland, O.
Beardsley & Piper Co., 2541 N. Keeler Ave., Chicago, Ill.